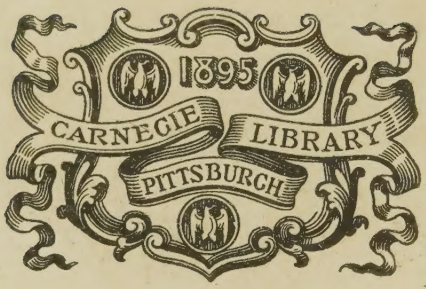

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ANNUAL REPORTS

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE YEAR ENDED JUNE 30,

1914.

REPORT OF THE SECRETARY OF AGRICULTURE.

REPORTS OF CHIEFS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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[CHAPTER 23, STAT. L., 1895.]

[AN ACT Providing for the public printing and binding and the distribution of public documents.]

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Section 73, paragraph 2:

The Annual Report of the Secretary of Agriculture shall hereafter be submitted and printed in two parts, as follows: Part One, which shall contain purely business and executive matter which it is necessary for the Secretary to submit to the President and Congress; Part Two, which shall contain such reports from the different Bureaus and Divisions, and such papers prepared by their special agents, accompanied by suitable illustrations, as shall, in the opinion of the Secretary, be specially suited to interest and instruct the farmers of the country, and to include a general report of the operations of the Department for their information. There shall be printed of Part One, one thousand copies for the Senate, two thousand copies for the House, and three thousand copies for the Department of Agriculture; and of Part Two, one hundred and ten thousand copies for the use of the Senate, three hundred and sixty thousand copies for the use of the House of Representatives, and thirty thousand copies for the use of the Department of Agriculture, the illustrations for the same to be executed under the supervision of the Public Printer, in accordance with directions of the Joint Committee on Printing, said illustrations to be subject to the approval of the Secretary of Agriculture; and the title of each of the said parts shall be such as to show that such part is complete in itself.

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REPORT OF THE SECRETARY OF AGRICULTURE.

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REPORT OF THE SECRETARY OF AGRICULTURE.

WASHINGTON, D. C., *November 14, 1914.*

SIR: Evidence abounds that more attention and more intelligent thinking are being directed to-day to the study of the fundamental problems in agriculture and in rural life than ever before. The last two years have been fruitful of significant State and Federal legislative and administrative measures designed to foster agriculture, to improve the distribution of agricultural products, and to better rural life. The people of the nation, urban and rural alike, are keenly interested in efforts to increase the supply of the necessaries of life, and recognize the supreme importance not only of making agriculture efficient and profitable, but also of making rural life comfortable, healthful, pleasurable, and attractive. Agriculture has made marked progress in a number of directions, but as an industry it has not kept pace with the other activities of the country. Relatively speaking, there has been a neglect of rural life by the nation. This neglect has perhaps not been conscious or willful. We have been so bent on building up great industrial centers, on rivaling the nations of the world in manufacturing and commerce, fostering these by every natural and artificial device we could think of, so busy in the race for populous municipal centers, that we have overlooked the very foundations of our industrial existence. It has been assumed that we have a natural monopoly in agriculture—that it could take care of itself, and for the most part we have cheerfully left it to do so.

The direction and emphasis of the national thought is changing, and we are witnessing the marshaling of many forces in the struggle for greater prosperity and for better conditions of living in the rural districts. We are witnessing a great increase in the expenditure of money to foster agriculture through all sorts of scientific and practical measures on the part both of the States and of the Federal

Government. Material results are forthcoming, and while great civilized nations of the world are in the throes of a deadly and destructive war, the farmers of every section of the Union except one are prosperous and are enjoying their work and its fruits free from the burden of militarism and the threat of wholesale destruction of life and property. Thoughtful men can not fail to be optimistic over the agricultural situation and prospects, but optimism must not blind us to certain shortcomings.

PRODUCTION.

The progress of agriculture reveals itself more particularly in its diversification, in the rise of minor crops to larger proportions, than in the increased production of staple products. For example, dairying in the last generation has become an exceptionally important branch of agricultural economy, the annual production including more than one and a half billion pounds of butter, a half billion pounds of condensed milk, and a third of a billion pounds of cheese, having a value of approximately $600,000,000. The production of orchard fruits exceeds 216,000,000 bushels a year, with a value of more than $140,000,000. The value of the annual production of vegetables is in excess of $400,000,000. The production of hay and forage approximates 100,000,000 tons, with a value in excess of $800,000,000; the poultry products of the United States have reached a point where their annual value is about one-half that of the cotton crop at normal valuations, and marked increases are noted in the quantity and value of the cereals.

The following table is suggestive. Special attention is directed to the statistics of quantity no less than to those of value. Census data for later years than 1909 are not available, but the indications are that the upward tendency in the production of all the commodities included in the table except corn has persisted.

Comparison of acreage and production of various farm products in 1899 and 1909.

[Taken from the Twelfth and Thirteenth Censuses.]

Product.	1899			1909		
	Acreage.	Production.		Acreage.	Production.	
		Quantity.	Value.		Quantity.	Value.
Cotton.....bales..	24,275,101	9,534,707	$323,758,171	32,043,838	10,649,268	$703,619,303
Cereals:						
Corn.....bushels..	94,913,673	2,666,324,370	828,192,388	98,382,665	2,552,189,630	1,438,553,919
Oats.....do....	29,539,698	943,389,375	217,098,584	35,159,441	1,007,142,980	414,697,422
Wheat.....do....	52,588,574	658,534,252	369,945,320	44,262,592	683,379,259	657,656,801
Barley.....do....	4,470,196	119,634,877	41,631,762	7,698,706	173,344,212	92,458,571
Rye.....do....	2,054,292	25,568,625	12,290,540	2,195,561	29,520,457	20,421,812
Rough rice...do....	342,214	9,002,886	6,329,562	610,175	21,838,580	16,019,607
Dairy products.....	.....	.....	472,276,783	.....	.....	596,413,463
Milk.....gallons..	.....	7,265,804,304	.....	.....	[1] 5,813,699,474	.....
Butter (made on farms)..pounds..	.....	1,071,626,056	.....	.....	994,650,610	222,861,440
Cheese (made on farms)..pounds..	.....	16,372,318	.....	.....	9,405,864	1,148,708
Poultry and eggs.....	.....	.....	281,070,693	.....	.....	509,195,232
Animals slaughtered on farms.....	.....	.....	189,809,229	.....	.....	270,238,793
All fruits.....	.....	.....	131,098,790	.....	.....	217,576,542
Orchard fruits, bushels.....	.....	212,365,600	83,750,961	.....	216,083,695	140,867,347
All vegetables.....	.....	.....	238,531,761	.....	.....	418,110,154
Potatoes....bushels..	2,938,778	273,318,167	98,380,110	3,668,855	389,194,965	166,423,910
Hay and forage, tons.....	61,691,069	79,251,562	484,254,703	72,280,776	97,453,735	824,004,877

[1] As reported from 16,069,298 dairy cows out of a total of 20,625,432 dairy cows. At this rate the total production of milk in 1909 would be 7,462,000,000 gallons.

We know that the wheat crop of 1914 of approximately 892,000,000 bushels is the greatest ever produced in our history, and that the crops of oats, barley, rye, potatoes, tobacco, and hay are unusually large. The cotton crop, forecast in October at 15,340,000 bales, is the second largest. The apple crop, estimated at 259,000,000 bushels, is the greatest ever harvested. The total production of six leading cereals is estimated to have been nearly 5,000,000,000 bushels, or about 428,000,000 bushels in excess of the crop of 1913. For the country as a whole the crop yields per acre were 2.3 per cent better than the average for the past 10 years. The average yield per acre of all the staple crops was 9.4 per cent greater than 1913, and, except for corn, oats, and flaxseed, greater than the 10-year average.

But after all our efforts, while there is an increased diversification of agriculture and both a relative and absolute increase in important

products, such as wheat, forage crops, fruits, dairy products, and poultry, we still note not only a relative but also an absolute decrease in a number of our important staple food products, such as corn and meats. In the former, in the last 15 years there has been no substantial advance. In cattle, sheep, and hogs there has been an absolute decline—in cattle, from the census year of 1899 to that of 1909, from 50,000,000 head to 41,000,000; in sheep, from 61,000,000 to 52,000,000; in hogs, from 63,000,000 to 58,000,000. Since 1909 the tendency has been downward, and yet during the period since 1899 the population has increased over 20,000,000. This situation exists not in a crowded country, but in one which is still in a measure being pioneered, in one which, with 935,000,000 acres of arable land, has only 400,000,000, or 43 per cent, under cultivation, and in one in which the population per square mile does not exceed 31 and ranges from 0.7 person in Nevada to 508 in Rhode Island.

Just what the trouble is, no one is as yet sufficiently informed to say. It can scarcely be that the American farmer has not as much intelligence as the farmer of other nations. It is true that the American farmer does not produce as much per acre as the farmer in a number of civilized nations, but production per acre is not the American standard. The standard is the amount of produce for each person engaged in agriculture, and by this test the American farmer appears to be from two to six times as efficient as most of his competitors. Relatively speaking, extensive farming is still economically the sound program in our agriculture, but now it is becoming increasingly apparent that the aim must be, while maintaining supremacy in production for each person, to establish supremacy in production for each acre. The continued solution of the problem here suggested is one which now seriously engages the attention not only of the agricultural agencies of the several States but also of the Federal Government.

Through every promising approach the Department of Agriculture is studying and attacking the problem of increasing production. Through breeding and selection, the improvement of cultural methods, and the control of plant diseases, experts in plant industry are lending their assistance. They are introducing new crops and better varieties of existing crops from other parts of the world, including drought-resistant plants for the semiarid regions of the West and

better forage crops for the South; they are breeding higher yielding varieties of staple and other crops; they are indicating better cultural methods and practices, encouraging standardization, and suggesting utilization and disposal of crops in such manner as to make them yield an adequate return to the producer; they are stimulating the citrus-fruit industry; and they have produced by hybridization new and comparatively hardy types of citrus fruits which will become important additions to the home supply of useful fruits, especially in the Southern States. They have established new plant industries in various parts of the country, such as date and cotton growing in Arizona and the Imperial Valley of California. They have pointed the way to the continued successful growing of cotton in boll-weevil districts. They are protecting the farmer against seed adulteration. In cooperation with other agencies, especially the Federal Horticultural Board, they are taking effective steps to safeguard the great potato industry of the nation. They have developed grain and cotton standardization to the point where beneficial results can be secured not only in further production, but also in more just and efficient distribution.

In like manner the experts of other bureaus have labored efficiently for the increased production of farm crops. The entomologists have pointed the way to the control or the extermination of many harmful insects. They have developed means for the control of the alfalfa weevil, assisted in the protection of crops against damage by chinch bugs and the Hessian fly, developed sprays for controlling deciduous-fruit insects, and lessened the injury to orchards by the apple-tree borers. They have devised protection against the tobacco horn-worm, carried on successful work in the eradication of the Rocky Mountain spotted-fever tick, studied the control of insects conveying disease to human beings, and rendered other service of marked value.

The experts of the Bureau of Soils have continued their studies of soils and have prosecuted their investigations into additional sources of fertilizer supply. They have extended the work of surveying and mapping the soil areas of the United States, having surveyed and mapped in detail since the inauguration of the work 329,539 square miles, or 211,000,000 acres, and, in addition, have made reconnoissance surveys of 434,000 square miles, or 278,000,000 acres.

THE MEAT SUPPLY.

The experts of the Bureau of Animal Industry have intelligently and zealously prosecuted their tasks, but it remains true that this country faces a serious situation in the matter of its meat supply. Just what factors have brought this situation about no one can define with certainty, and no systematic attempt to define them has been made until recently. Realizing the urgency of the problem, I have appointed a committee, consisting of the best authorities I could discover, to study the subject. This committee is making a survey of the whole field and will report at the earliest practicable moment. Its study embraces an investigation of production and consumption and of the methods of producing, finishing, and marketing meat. When a conclusion is reached, such measures as may be helpful for increasing production and bettering distribution will be inaugurated.

In the meantime, however, certain things are clear, and definite plans for increasing the meat supply are in operation and can be continued with promise of large results.

It is evident that we have been considering the meat supply of the nation too exclusively in terms of the big ranch and of beef animals. Obviously it is important that we continue to help the cattlemen and to assist in further developing the big ranch. No pains will be spared to do this. The department is now spending money to develop the live-stock industry in connection with the reclamation projects and is asking for more. But unquestionably the largest hope for a considerable increase in our meat supply lies in four other directions: First, in a more satisfactory handling of the public grazing lands; second, in systematic attention to the production of beef animals in the settled farming areas of the country, particularly in the South; third, in increased attention to the smaller animals, such as swine and poultry; and fourth, in the control and eradication of the cattle tick, hog cholera, tuberculosis, and other animal diseases and pests.

The present methods of transforming the grasses of the public grazing lands into beef and mutton are generally conceded to be wasteful. It is estimated that under a proper system the quantity of beef and mutton produced on these lands could be increased by at least 50 per cent. The public grazing lands, in addition to

150,000,000 acres in the National Forests, embrace about 300,000,000 acres. Under the present laws any person may graze any number of stock at any time on any part of these 300,000,000 acres of the public grazing lands or grazing lands outside of National Forests. In earlier years, when there were comparatively few cattle on the range, the treatment of the lands as common worked fairly well, but the increased domestic and export demand for meat has resulted in overgrazing. Unseasonable and excessive grazing weakens the vitality of the range plant and permanently reduces the crop. Furthermore, as years have passed the area of the grazing lands has been greatly reduced through the taking up of homesteads, and in many cases the better lands were thus disposed of. There is no doubt that under legislation providing for an intelligent system of handling grazing lands a very large increase in the meat supply of the nation can be secured. This is not mere conjecture. The opinion is based on the experience not only of the State of Texas in handling its public lands, but also on that of the Federal Government in the management of the grazing lands in the National Forests.

For 10 years the United States Government has been conducting a successful experiment in the forests. So quietly has this experiment proceeded that few people have known even of its inauguration, recognized its importance, or appreciated its results. Under the Forest Service system, annual grazing permits, with the necessary regulatory provisions, have been in force for nearly a decade. The results have been striking. In 1905, 81 acres supported but one animal; in 1913, the average was one animal for each 51 acres. This increase of 59 per cent has been due to many factors which can not be detailed here. The net results are that the grazing lands in the forests under permits to nearly 29,000 live-stock growers support 1,600,000 cattle and horses, with their calves and colts, and 7,600,000 sheep and goats and their lambs and kids. In addition, the forest ranges furnished temporary grazing to millions of other animals which passed through the forests under crossing permits. The capacity of the range has not been reached. There is room for more animals on this part of the public domain. It has been demonstrated that under systematic management the grazing value of the lands can be restored and increased, that the range can be made to produce heavier animals, even with increased numbers, and that these lands can be improved

faster in use than in idleness. Even with the very moderate grazing fees charged, the stockmen pay the Government over $1,000,000 annually. Their gross receipts probably exceed $30,000,000, and their invested capital is more than $100,000,000. A proof of what this constructive handling of the range problem signifies may be found in the desire of many stockmen to have the department's system of grazing extended to the open public range outside the National Forests.

There is no question that the average farmer in the settled areas of the United States generally, North, East, South, and West, can produce without great expense a larger number of beef animals, if only as by-products, to the betterment of his farm economy. In this direction the farmer in the South enjoys unusual opportunities. It is further apparent that farmers everywhere, if they will apply existing knowledge, can largely increase the supply of swine and poultry products, which constitute a large and growing part of the consumption of the average family. In no other way can a considerable addition be so quickly made to our meat supply as through increased attention to poultry and swine on all the farms of the nation, and particularly in the South, where the deficiency is so marked. The annual value of the poultry products alone aggregates half a billion dollars, or 50 per cent of the total value of the cotton produced in the United States. The last census, however, shows a lamentable neglect of live stock in the South. While in Iowa the average farm has 6 milch cows, in North Carolina and Alabama it has less than 2, and in South Carolina 1. While in Iowa the average farm has 35 hogs, in North Carolina and Alabama it has less than 5, and in South Carolina less than 4. While in Iowa the average farm has more than 108 head of poultry, in North Carolina and Alabama it has less than 20, and in South Carolina less than 17. An investigator has recently said that the average farm home in Georgia produces less than 2 eggs a week; about two-thirds of an ounce of butter and two-thirds of a pint of milk a day; one-third of a hog, one-twelfth of a beef, and one one-hundredth of a sheep a year for each member of the family; and that the cotton crop of the State does not pay the State's food and feed bill. No Southern State is giving sufficient attention to the production of foodstuffs either for human beings or for live stock. A conservative estimate indicates that Texas imports from other States annually more than $50,000,000 worth of wheat, corn, and oats; Georgia more than

$24,000,000; South Carolina more than $20,000,000. Twelve Southern States import more than $175,000,000 worth of these three commodities and $48,000,000 worth of meats, dairy products, and poultry products. It may be admitted that most of these States should not undertake the production of these commodities for foreign or interstate shipment in competition with the great States of the Middle West, but every student of the subject must recognize the unwisdom of the neglect to produce enough of these things for the consumption of their people and for the laying of the foundation of a prosperous live-stock development.

Too exclusive devotion to a single crop anywhere is unwise for normal times and spells disaster in times of disturbance. It is bound to produce just such a catastrophe as has befallen the South in the present emergency. It prevents the full utilization of land and labor, fails to fill the gaps in the work schedules, and furnishes no reserve.

If farmers in the South had heretofore practiced diversification on a sufficiently large scale, producing their own home supplies, that section would not be in its present hard case. The experts of this department are laboring earnestly to bring about a better direction of the agricultural activities of the South. If this is especially successful the coming season, and a much larger part of the land, labor, and capital of the South is devoted to the production of foodstuffs, relief will be afforded in this emergency, and there will be promise there of a permanent, wiser farm economy. This undertaking will require the cooperation in the South of all the agents of the department, of the farmers, of the business men, and of the bankers. If the department had available an additional $100,000 or $150,000 with which to place a number of experts in live stock, marketing, and other subjects in the field, much greater headway could be made.

But an easier and more definite program for a large increase in the meat supply involves the eradication of the cattle tick, of tuberculosis, and of hog cholera, and the prompt suppression of serious outbreaks of such diseases as the foot-and-mouth disease. The Federal Department of Agriculture inspects meats passing into interstate commerce. Of 57,000,000 animals inspected in the fiscal year 1914, 533,000 were found to be infected with tuberculosis. This disease is increasing. It is estimated that hog cholera caused a loss in 1913 of

over 6,000,000 hogs, valued at more than $60,000,000, and that the cattle tick causes an annual loss of from $40,000,000 to $100,000,000 or more and prevents the proper development of the live-stock industry in the infected area.

The department is now directing the expenditure of a fund of $500,000 for the eradication of hog cholera, and many of the States are likewise spending considerable sums. The two agencies are working in cooperation and are making experimental and field demonstrations in the control of this disease. Unquestionably the appropriation of half a million dollars for the eradication of hog cholera should be continued.

The work of tick eradication is progressing. It has resulted to date in the clearing up and freeing of 220,000 or more square miles, an area exceeding that of Georgia, Florida, Alabama, and Mississippi combined, or greater than that of France or Germany. There still remains an area about double that of the State of Texas, or more than twice that of Germany or France, which is still infested. A more vigorous effort with larger funds for the clearing of this area would be wise economy.

Other animal diseases interfere seriously with meat production, and from time to time great actual loss in cattle and hogs and still greater disturbance of industry are caused by the foot-and-mouth disease. This disease affects cattle, sheep, other ruminants, and swine. It manifests itself by abnormal elevation of temperature and by ulcers or vesicles in the mouth and on the feet. It is not necessarily fatal, but frequently affects very seriously the value of the animals. There were outbreaks of foot-and-mouth disease in this country in 1870, 1880, 1884, 1902, and 1908. Since the close of the fiscal year 1914 the sixth outbreak has occurred. The first three, those in 1870, 1880, and 1884, were comparatively trifling. Those in 1902 and 1908 were more grave. The present is the most serious and extensive of all.

In 1902 the outbreak occurred in the New England States. In 1908 it originated in Detroit. The origin of each of these outbreaks was traced to the importation of vaccine virus for the propagation of vaccine for use in vaccinating people against smallpox. The vaccine virus was imported from Japan, where the foot-and-mouth disease exists. Each of these outbreaks was stamped out by methods which have proved most effective in preventing the disease from

gaining a footing. These methods involved the killing of all infected and exposed animals, the burying of the carcasses, and the thorough disinfection of all premises with which the animals may have come in contact.

On October 18, 1914, the Bureau of Animal Industry of this department learned that cattle in the vicinity of Niles, Mich., were infected. It was thought for a time that the trouble might be confined to two counties in Michigan and two adjoining counties in northern Indiana, but evidently before the disease was reported and before it was diagnosed shipments of infected animals passed through the Chicago stockyards. Upon tracing shipments from these yards animals infected with the disease were found at points in Michigan, Indiana, Ohio, Wisconsin, Pennsylvania, Maryland, New Jersey, Kentucky, Iowa, and Massachusetts. Subsequent points of infection have been discovered. The existence of the disease in Montana has been traced to animals from the infected area in Wisconsin, and its existence in Washington has been traced from animals which crossed the trail of the Montana herd. The department has taken every step possible to control the disease and to prevent its spread. It has worked in close cooperation with the State authorities and with great numbers of individuals and of associations of individuals. It has pursued its former policy of purchasing diseased and exposed cattle at an appraised value and of slaughtering and burying them. It has established and maintained a very strict quarantine. The expense of this task will be very great, and it will be necessary to ask the Congress for an emergency appropriation of several millions of dollars. The interests at stake are vast and justify any reasonable expenditure.

It is not possible at the present time to state positively what the origin of the present outbreak was. The disease is highly contagious. It may be carried by birds, dogs, cats, rats, or ruminants, or by human beings passing over territory which diseased animals have traversed. Horses going over infected ground may convey the disease in dirt adhering to their feet. When one animal in a herd becomes affected it has usually spread to all the others. As has been stated, the outbreaks in 1902 and 1908 were traced to vaccine virus. The most plausible suggestion as to the origin of the present outbreak is that it was introduced with importations of an article used in tanning. This article is imported from several countries. There

is in the vicinity of Niles, Mich., a small tannery using the article in question, and swine owned by employees of the tannery kept in this vicinity were the first animals known to have contracted the malady. Since the disease exists in a great part of Europe, in the Orient, in South America, and other places, there will be danger so long as there is any trade or travel with such countries. Apparently the only certain way to prevent the introduction of the disease into this country from abroad is absolutely to isolate this nation from others. The only reasonable thing which can be done is to enforce as carefully as possible the inspection laws, to give the Department of Agriculture sufficient authorization and emergency funds to cope with the disease when it does appear, and to institute such scientific inquiry and experiments under absolutely safe conditions as may be practicable in an attempt to discover the cause of the disease and to ascertain and apply the remedy. The present situation suggests the wisdom of legislative action to this effect. If the interval between the sessions of Congress had been longer, the department would have been without adequate funds to deal with the problem.

FARM ECONOMICS AND BUSINESS METHODS.

A different but strikingly important aspect of production and of farm operations is the application of economic principles and of sound business methods. This subject has received little consideration. In every other industry successfully prosecuted the employment of sound business principles from the outset is regarded as a prerequisite. In this direction, as in others, farming has lagged behind, and the several farming activities have been too largely conceived as being separate rather than as closely interrelated. It is highly necessary that the farmer, as well as any other business man, should know at all times just how his business stands, what parts are profitable, what unprofitable, and how he should redirect his activities to assure success. For this purpose the farm must of necessity be looked upon as a whole. It is the object of the Office of Farm Management to do this. The service of the economist should be enlisted in all our agricultural undertakings. All agricultural enterprises and the work of all agricultural establishments are economic in their character, and yet it is true that up to the last two years neither the farm as such nor any institution or establishment dealing with the farm has invoked the assistance of the economist. For the most part the economist has

not realized the obligation resting upon him and has paid scant attention to the urgent economic problems in the field of rural life. It is probably true that not more than 10 or 12 of the economists of this country could qualify as experts in rural economics. Their attention has been somewhat exclusively absorbed by problems growing out of the industrial life of the nation and out of its international relations. The emergence of acute business problems in agriculture and the complexity of the problems of distribution and organization justify a different attitude on the part both of the economist and of the authorities responsible for agricultural leadership. The inauguration of work in farm management is a hopeful indication of change.

The business of the student of farm management is to make an analysis of the operations of the farmer, to study the proper adaptation of the type of farming to local conditions, such as soil and climate, the size of the market, market demand and transportation, the quality of the farm business, its diversity, its organization, the distribution of farm enterprises, and the costs of each sort of product. The investigations of the Office of Farm Management are yet in their infancy, and there is much to learn in this branch of agricultural science, but the inquiries thus far pursued furnish a deeper insight into the causes of success and failure in farming and give promise of helpful results in the increase of production on a profitable basis.

DISTRIBUTION.

A constructive agricultural program must of necessity contemplate distribution as well as production, and, vital and urgent as are the direct problems of production, even more important in a sense and more immediately pressing are the problems of distribution and marketing. The solution of problems in this field is essential not only for the increase of production but also for the elimination of injustice, and for the guaranty, on the one hand, to the producer that he shall receive a fair reward for his labor and the right value for the specific product which he sells, and, on the other, to the consumer that he shall receive the exact commodity for which he pays a specific price. The attempt by governmental agencies to solve problems of distribution and marketing is recent. Considerable

headway has been made, and the indications are that the thought both of the State and of the nation has been keenly aroused and that further effective measures will be adopted. One of the greatest weaknesses of American agriculture at the present time arises from the lack of a knowledge of the facts of distribution, of business organization, of cooperation, and of resident leadership. Attention has heretofore been directed to the new enterprises of the department in marketing, in cooperation, rural credit, and the general organization of rural communities for their intellectual, sanitary, and social betterment. Already the Congress has laid the foundation for work along these lines by making available a fund of $240,000 and by enacting the Cotton Futures Act.

Other measures of great importance, such as those dealing with cotton standards, grain standards, a permissive warehouse system, and land-mortgage banks, have been pushed toward completion. Generally speaking, all these measures have for their object the elimination of waste, the systematizing of the processes of distribution, the injection of adequate business methods into these activities, and the development of the requisite degree of business cooperation among farming units. Several of these measures merit further comment.

MARKETING.

Sufficient indication of the scope of the work of the Office of Markets was given in the department's last annual report. Initiated a little more than a year ago with an appropriation of $50,000, an expansion was made possible by the increase in the amount to $200,000 in the current appropriation for the department. In a new and untried field of this kind the first concern must be to secure the requisite number of trained men, very difficult to find, who can undertake efficiently the several lines of investigation. The organization has now reached a fair stage of development and is actively prosecuting its tasks. It has obtained much reliable information concerning cooperative marketing and purchasing. It has demonstrated that cooperation in some form is much more prevalent in the United States than is generally believed. A record of more than 8,500 marketing associations, about 2,700 cooperative and farmers' elevators, 2,500 cooperative and farmers' creameries, and more than 1,000 cooperative fruit and produce associations has been secured. While the survey is not complete, it is reported that over a billion dollars' worth of

agricultural products are annually marketed by cooperative and farmers' marketing associations.

The majority of these associations have furnished the office detailed statements of their plans of organization, of the products handled, of the forms of business, and of other important items, including constitutions, by-laws, and financial statements. The conclusion seems justified that in communities where farmers' associations are properly constituted and operated better results are obtained than under a system of individual handling. Advantages present themselves in the standardizing and packing of products and in the discovery of the best daily market. Much information has been secured as to the laws of the various States under which such organizations may be created. The effort is being made to determine the principles on which the enterprises that have succeeded have operated and those upon which the enterprises that have failed have proceeded. The business practices of the enterprises have been carefully considered, and the results of investigation are being tabulated and formulated. At the earliest possible moment the results will be incorporated in circulars and bulletins. Likewise, inquiries have been set on foot concerning market centers, the market surplus, the rate of movement, the outlets for commodities, the prices of specific products by definite trade areas, and the possibilities of increasing distribution in an economical way.

Lists of producers, producers' organizations, shippers, transportation agents, and officials from whom information on specific perishable products may be secured are being compiled. For example, the records show that the number of points from which commercial shipments are known to originate for certain specific products are as follows: Strawberries, 900; peaches, 1,800; tomatoes, 600; cabbage, 1,700; onions, 1,500. A special inquiry has been made concerning the commercial storage of cabbage and onions in the North, to guide growers in southern areas. In all these directions information has been furnished to producers in different sections. There have been special investigations of the marketing of peaches and cantaloupes in Georgia; of cantaloupes and truck crops in North and South Carolina; of cantaloupes, strawberries, and truck crops in Virginia; of peaches, cantaloupes, and strawberries in Delaware; of peaches in Maryland and West Virginia; of peaches, strawberries,

and truck crops in New Jersey; of peaches and truck crops in Pennsylvania; of potatoes in Maine; of cantaloupes and cabbage in Colorado; of truck crops in Mississippi and Texas, and of fruit and potatoes in Arkansas, Missouri, Tennessee, and Kentucky. Much advice and assistance have been furnished to growers in these sections.

City marketing and distribution, including the various types of public markets, wholesale terminal markets, and auctions and other methods of distributing food products in cities, have likewise been the subjects of investigation. At Jackson, Mich.; Providence, R. I.; Trenton, N. J.; Philadelphia, Pa.; St. Louis, Mo.; and Jersey City, N. J., in response to requests from city officials or producers' organizations, the municipal public market situation has been analyzed. Personal investigations have been followed by extensive reports containing specific advice regarding suitable types of markets, their design, cost, construction, and advantageous location, the arrangement of transportation facilities, and many other details. Municipally and privately owned public retail markets, producers' wholesale and retail markets, wholesale terminal markets, and auctions have been studied in Boston, New York, Norfolk, Baltimore, Washington, Albany, Rochester, Buffalo, Cleveland, Detroit, Chicago, Madison, Pittsburgh, Cincinnati, Columbus, Toledo, Dubuque, Des Moines, Kansas City, and Denver. Details have been secured of market costs, maintenance, construction, sanitation, location, offerings, prices, and the service, or lack of it, which these markets render the people.

A special object of inquiry has been the possibility of marketing by parcel post and express. Many experiments have been conducted by sending, receiving, and examining experimental shipments. Exhibits have been made at many gatherings. The first experiments in this direction were made with eggs, in family-size lots, the results of which have been published in Farmers' Bulletin No. 594. It has been found that where proper care in packing and handling commodities is exercised the marketing of certain products by parcel post and express can be profitably undertaken.

The marketing of live stock, of meats, and of animal by-products has been investigated. The object has been to determine the relative efficiency of the marketing of beef cattle in the central and local markets in the various producing areas of the United States, and to ascertain in what particular improvements may be made.

The areas selected for these studies were the East, the South, the corn belt, the Northwest, the Southwest, and the Pacific slope. Data have been obtained chiefly by selecting typical shipments of cattle whose approximate cost of production is known, by following them from the farm, ranch, or plantation through the stockyards, packing houses, and wholesale and retail markets to the consumer, and by keeping itemized accounts covering the transportation, selling, and slaughtering of the live stock and the distributing and retailing of the beef. As far as possible, normal factors of loss, such as mortality, shrinkage, condemnations, bad accounts, and depreciation, and also items of expense which the consumer must pay indirectly, such as rent, heat, light, handling, storage, cutting, and delivery, have been considered in these statements. In this manner 12 lots of beef cattle have been traced from Oregon, Montana, Kansas, Texas, Alabama, Illinois, and Virginia to the open market at Portland, Oreg., Fort Worth, Kansas City, East St. Louis, Chicago, and Baltimore. The beef yielded by the cattle has been followed to its destination, the principal shipments having gone to Portland, Oreg., Seattle, Indianapolis, Fort Wayne, Detroit, Cleveland, Baltimore, Jersey City, New York, Brooklyn, Providence, Boston, and a number of smaller eastern cities, and ultimately having been sold to family, hotel, restaurant, and dining-car trade.

Information has also been obtained relative to the methods and cost of dressing and handling beef by local butchers in various sections and under various conditions. Tests of this kind have been arranged at Urbana, Ill.; Auburn, Ala.; South Haven, Mich.; at the municipal abattoir at Paris, Tex.; and at the farmers' cooperative packing house at La Crosse, Wis.

A directory and descriptive file of all centralized live-stock markets in the United States, including their railroad facilities, stockyard equipment, selling agencies, buying interests, number and character of receipts and shipments, and the sources of supply and outlets for finished meat products and by-products, is now being compiled.

Further investigations and a more complete analysis of the facts in hand will be necessary before definite conclusions can be stated as to the relative cost of transporting, slaughtering, wholesaling, and retailing beef, and the extent to which the cost may be reduced in each instance. Each of the large markets draws its supplies from at least several States, and some of them from a larger area. During

the present grass season, for example, Chicago has received Mexican, Canadian, and Florida cattle at about the same time. Steers raised in California by an Oregon operator have been shipped through Denver to Omaha and the beef sent to points on the Atlantic coast. Hogs raised in Illinois and sold at Indianapolis have been slaughtered at Boston and a part of the cured bacon shipped to Los Angeles. Michigan dressed veal calves expressed to South Water Street commission houses at Chicago have been returned to the identical shipping points from which they came to fill orders from local retail markets. The importance of this work and the results thus far obtained justify a larger support of this service, especially as its organization has now progressed to the point where it is possible to utilize ampler funds with the requisite efficiency.

GRAIN AND COTTON STANDARDS.

The matter of the standardization of grades of grain and cotton is of great practical consequence to the farmer and to farming. This is a work upon which the experts of the Bureau of Plant Industry have been engaged for years. During the last year the adequacy of the data accumulated with regard to corn made possible the formulation and promulgation of grades for that grain which, if generally adopted and uniformly applied throughout the country, will simplify the relations between producers, dealers, and consumers. Under these grades, fairly used, the grower or shipper of a superior quality of grain will be in a position to demand from the buyer the fair value to which the quality of his product entitles him. On the other hand, the producer of a product of inferior quality will receive a lower return.

The beneficial influence upon agriculture of a uniform system of grading staple crop products will be very great through the financial incentive afforded the farmer to improve the quality of his product by the careful selection of varieties, skillful culture, and adequate and effective methods of harvesting, handling, and protecting it while in his hands. Advice that he improve his methods, no matter how sound and well intended, will not make and ought not to make much impression upon him unless it can be clearly demonstrated that it will pay him to improve his product and his handling methods. Concrete evidence of the profitableness of this course in the form of larger net returns for his output will do more than any other single

factor to arouse action and effective interest in crop improvement. Investigation of the handling and standardization of other staple grains, particularly wheat and oats, is proceeding. It is gratifying that a considerable proportion of the State grain-inspection departments and commercial organizations maintaining grain-inspection departments located in the grain belt and the Gulf coast sections have already adopted the Government grades for corn or have declared their intention to adopt them.

In addition to the continuance of the preparation and distribution of standard grades for cotton, promulgated under statutory authority some years ago, investigation of the spinning value of those grades has recently been undertaken with a view to determine as accurately as possible the relative value of the various grades through tests conducted on a commercial scale. Methods of determining the exact length of staple of cotton have been developed, which may eventually be applied in the cotton trade. Measures for securing the adoption of grain and cotton standards in trade have occupied much of the time of the Congress, and the indications for their enactment into law are favorable.

WAREHOUSE SYSTEM.

Another proposal is that for a permissive warehouse system for grain and for cotton. The study by the department of the warehousing of grain has not proceeded as far as its study of the warehousing of cotton, but this work is being prosecuted actively, and the results should be available in the near future. Interesting results have already been furnished by the investigation of the cotton warehousing situation. A detailed survey of the State of Georgia shows that there are in that State more than 1,000 warehouses in operation. Reports from 700 of these give a storage capacity of 1,200,000 bales uncompressed. The remaining 300 probably have a total capacity of at least 300,000 bales. To these may be added the storage houses belonging to the cotton mills of the State, which take care, approximately, of 400,000 bales. In North Carolina there are 129 warehouses, with a storage capacity of about 200,000 bales, and the mills of the State can store 375,000 bales. The situation in South Carolina, Alabama, and Mississippi is similar to that in Georgia. Virginia, Tennessee, Florida, Louisiana, and Texas have warehouses with a storage capacity exceeding the annual production,

but these are located for the most part at shipping points, such as Norfolk, Memphis, Jacksonville, Pensacola, New Orleans, Houston, and Galveston.

Comparatively few of the small towns have warehouses. Taking the entire cotton belt, it is probably true that the warehouses now in existence could store the cotton that would be offered during any ordinary season, but the warehouses are not evenly distributed. Most of them are constructed without reference to the standards recognized by underwriters and have to pay a high insurance rate. Few of them are bonded, and financial institutions which might advance money on cotton certificates from bonded warehouses are cautious in dealing with them. If the warehouses in existence were remodeled so as to comply with the underwriters' requirements and were bonded, and if adequate business methods were adopted, the financing of the cotton crop would be materially improved. Such a system would furnish relief in times of emergency and would form a useful part of a normal distributive system. It is probable that a Federal law for a permissive warehousing system would stimulate this desirable development.

COTTON FUTURES ACT.

The Cotton Futures Act is the first definite, systematic, legal approach to the solution of difficult problems in this field of distribution. Interest in the economics of the cotton situation has grown rapidly in recent years and has been especially marked during the present season because of the difficulties arising out of the European war. For many years there has been a growing dissatisfaction with the future markets as a means of price insurance. The demand for reform in certain practices and methods of the exchanges resulted in the passage of the futures act, which is designed to increase the safety of the future contract as an insurance and to limit somewhat the possibility of manipulation.

The enactment of this legislation is of importance to cotton growers because of the fact that in normal years the price when the farmer sells is usually based directly on the quotations of the future market. It is generally admitted that the undesirable features of future transactions are due to the number of different standards in use in the markets, to the fixed-difference system of establishing the value of other grades than middling, to the fact that very low

qualities of cotton suitable for spinning use by only a few mills sometimes compose the larger part of the warehouse stock of an exchange and are deliverable on contract, to the fact that tenders of cotton under contracts do not indicate the qualities to be delivered, and to the fact that under the pro forma delivery practice several weeks sometimes elapse before the person who is obligated to receive cotton knows the grades tendered to him, for which he has contracted to pay at the time of delivery.

The act, by prescribing a form of contract, provides that future contracts must be based on uniform standards established by the Department of Agriculture; prohibits the pro forma deliveries and the tendering of cotton of less than seven-eighths inch in staple in settlement of future contracts; provides for the settlements for grades above or below the basis grade in accordance with prevailing commercial differences; allows an appeal to the Department of Agriculture in case of a dispute as to grades, staple, or quality of cotton tendered in settlement; lodges power with the department to ascertain commercial differences actually prevailing in the spot markets, and thus to safeguard the exchanges from unintentional error which might subject their contracts to taxation; makes it the duty of the department to determine which are bona fide spot markets, and to designate the ones which shall be used as a basis for determining commercial differences; and imposes a prohibitive tax upon contracts for the future delivery of cotton on a basis price if they do not conform to the terms of the act.

The act as a whole is constructive and regulatory, not destructive or oppressive. It recognizes that the exchanges, when they are properly conducted, may benefit both the purchaser of raw cotton and the manufacturer of goods. The administration of this act has been intrusted immediately to the Office of Markets in collaboration with the Bureau of Plant Industry. A new standard set of grades, more truly representative of American cotton than any hitherto in use, has been prepared. The requisite surveys have been set on foot, tentative regulations have been prepared, and hearings held with a view to secure advice and suggestions for the revision of the regulations and the adoption of them in their ultimate form. No effort will be spared to lay the foundations for the enforcement of the act and to give the necessary information at the earliest possible moment, so that the exchanges of the country which desire to do so

may operate in accordance with the terms of the new law even before it becomes effective.

RURAL CREDITS.

Closely related to the production and distribution of farm products is the securing of capital by farmers on better terms. This problem has attracted the profound attention of the country and still awaits a full solution. The difficulties arise partly from the diffusion and sparseness of the rural population, partly from the failure of proper business adjustment, and partly from the inadequacy of the security which part of the farming population normally can offer for loans. The problem is one of extending the banking machinery and facilities more intimately into the country districts for the convenience and the assistance of the rural population and of the effective mobilization and utilization of the resources of the country people themselves.

The chief difference of opinion arises over whether there should be special aid furnished by the Government. There seems to be no emergency which requires or justifies Government assistance to the farmers directly through the use of the Government's cash or the Government's credit. The American farmer is sturdy, independent, and self-reliant. He is not in the condition of serfdom or semiserfdom in which were some of the European peoples for whom government aid was extended in some form or other during the last century. He is not in the condition of many of the Irish farmers for whom encouragement and aid have been furnished through the land-purchase act. As a matter of fact, the American farmers are more prosperous than any other farming class in the world. As a class they are certainly as prosperous as any other great section of the people; as prosperous as the merchants, the teachers, the clerks, or the mechanics. It is necessary only that the Government, so far as geographic and physical conditions permit, provide machinery for the benefit of the agricultural classes as satisfactory as that provided for any other class, and this the Government has attempted and is attempting to do.

It is the judgment of the best students of economic conditions here that there is needed to supplement existing agencies a proper land-mortgage banking system operating through private funds, just as other banking institutions operate, and this judgment is shared by the leaders of economic thought abroad. The national banking system up to the present time has labored under restrictions imposed

by law which made it impossible for the national banks to solve the problems in the most effective way. State banks with fewer restrictions, with smaller capital requirements, and ability to lend on real estate have established more intimate touch and have perhaps rendered greater assistance. Likewise certain agencies, such as building and loan associations, insurance and mortgage debenture companies, and the cooperative credit associations recently created by State legislation in Texas, Massachusetts, New York, and Wisconsin, operate to extend capital to the farming districts, and thereby in a measure tend to cut down the rate of interest.

When the national banking law, commonly called the Federal Reserve Act, was under discussion in Congress, the matter of farm credits was considered and debated, but it was decided that the subject as a specific program should be separately dealt with in another act. The Federal Reserve Act was passed with a view to the improvement of the banking conditions of the country in the interest of all classes; to the restoration of normality in banking; to the establishment of a reserve or banking power which could be utilized in times of emergency; and therefore with a view to secure good banking at all times and to prevent panics. It is not a banker's law, or a business man's law, or a manufacturer's law, or a farmer's law; it is a law for all classes—for all the people. However, there were incorporated into the act several very important provisions which had in mind specifically the needs of the farming classes and the possibility of extending banking facilities to the rural districts.

It was specifically provided that a Federal reserve bank might "discount notes, drafts, and bills of exchange arising out of actual commercial transactions—that is, notes, drafts, and bills of exchange issued or drawn for agricultural, industrial, or commercial purposes, or the proceeds of which have been used or are to be used for such purposes." The Federal Reserve Board was given the right to define the character of paper thus eligible for discount. It was further distinctly provided that nothing in the act should be construed to "prohibit such notes, drafts, and bills of exchange secured by staple agricultural products, or other goods, wares, or merchandise from being eligible for such discount." It was provided that the ordinary notes, drafts, or bills admitted to discount should have maturity at the time

of discount of not more than 90 days, but that notes, drafts, and bills drawn or issued for agricultural purposes or based on live stock might have a maturity not exceeding six months. Not only is paper arising out of agricultural transactions made eligible under the act, but it is given a longer maturing period than other forms of paper. This apparent discrimination arose naturally out of the fact that agricultural operations are seasonal and involve a longer period than ordinary commercial transactions.

Again, it is provided in the act that national banking associations not situated in the central reserve cities may lend on improved and unencumbered farm lands within the Federal reserve district, and that such loans may be made for any period up to five years. Such loans may not exceed 50 per cent of the actual value of the property. Any national bank under this provision of the act may lend on farm lands an amount in the aggregate equal to 25 per cent of its capital and surplus or one-third of its time deposits. The Federal Reserve Act, therefore, so far from discriminating against the farming classes, distinctly bears them in mind, and while not discriminating in favor of them takes just and particular knowledge of their requirements.

The matter of additional legislation concerning farm credits was promptly brought to the attention of Congress by the President at the regular session in his annual message, and many experts have been giving persistent and careful attention to the problem.

The explanation of why special banking arrangements were devised abroad, but have not been extensively planned and operated in this country, is to be found in the difference in economic, social, and banking habits and conditions. This is the only large country that may be said to have the ordinary banking habit developed in a high degree, with banking and lending associations democratized and in touch with the masses of the people. The great masses of people in a number of European countries do not have the ordinary banking habit and know little about banking practices. The habit of depositing money in banks, of checking against such deposits, and of making loans through banks in such countries is not general. This may be illustrated by a reference to the Bank of France. This bank, with a billion dollars of bank notes, has only $285,000,000 of deposits. A bank can utilize its assets either through notes or through discount and deposit and checking. In this country the assets of a bank are utilized to a slight extent through bank notes, the total volume being

about $725,000,000, while the total deposits in all the banks are $17,000,000,000. This testifies to an unusual development of the banking habit among our people. Partly because of the lack of the ordinary banking habit on the part of European peoples, partly because of the lack of banking facilities, and partly because of other social and economic factors, special agencies had to be devised. There was great need for some addition to their machinery. The land mortgage and the cooperative credit arrangements grew up of necessity. Likewise, the savings banks were created for similar reasons. It is noteworthy that only recently have savings institutions been established in great numbers in this country, and that still more recently the Government postal savings system has been evolved.

Notwithstanding the fact, however, that the people of the United States have ampler financial agencies than any other in the world, and have developed the habit of using these agencies to a greater extent than any other people, students of rural problems have been keenly alive to the need of further improvements. They have insisted upon extensions of the national banking facilities and the creation of special agencies in intimate touch with farmers with a special view to the betterment of financial conditions in the country. At least two definite measures have been prepared and have received special consideration. They are similar in many respects. They provide, in brief, for land-mortgage associations with small capital, which may make loans on farm mortgages within a district of a State or within a State to the extent of 50 per cent of the real values of the farms. The money arising from such loans is to be used for productive purposes on the farm on which the security is based. It is contemplated in one way or another, either through separate associations or through a central agency, that debenture bonds may be blanketed on the mortgages and offered to the public. It is proposed that the operations of the system shall be supervised by a central agency in Washington and that there shall be adequate safeguards in the way of examination and inspection. It is thought by students of the question that such debenture bonds would be safe, would attract capital, and would bring into the investment field, especially, small holdings scattered through the country which do not now easily find satisfactory investments. A plan of this kind, operating through private funds, should work safely and would probably result

in a short time in systematizing credit transactions in rural districts and in reducing the rate of interest.

The Office of Markets and Rural Organization has continued its study of rural credits. Information bearing on farm-mortgage loans has been secured from two-thirds of the savings banks, trust companies, and State and private banks in the United States. The estimated total of farm mortgages held by these banks as loans exceeds $930,000,000. This fund is very unevenly supplied. Iowa banks alone furnish nearly 100 millions. Illinois and New York approximate 85 millions each, California 67 millions, and Missouri 58 millions. In Indiana, Vermont, and Minnesota the sum in each exceeds 45 millions. The total of farm mortgages held by these banks in the 10 States of the cotton belt is approximately the same as that held by Iowa banks.

Bankers in many States, especially in the Middle West, furnish almost as much money for farm loans through their activity as middlemen as they do through loans from their own bank funds. In such cases the banker acts as an agent, usually for some insurance company, mortgage company, or other bank. It is estimated that approximately $565,000,000 is thus handled through members of State, private, and savings banks and trust companies.

Information secured from insurance companies shows that more than $600,000,000 of their funds are invested in farm-mortgage loans. While mainly confined at present to the corn belt, these investments are being extended into the South and West. The companies have trained field inspectors or rely upon the statements or guaranties of local agents as to land values. Insurance companies usually limit their loans to 40 per cent of the value of the security and to a fixed maximum per acre. The prevailing period of such loans is five years, with the privilege of prepayment on interest dates.

The business of existing mortgage companies in the United States is often that of agents or brokers who bring borrower and lender together and render other services connected with mortgage loans without assuming liability. Such business can be built up with very little capital. The mortgage is made out directly to the lender, who assumes all responsibility. It is evident that the market for such loans is restricted to investors who know the nature of the security, who are willing to lend the particular amount desired, and who will assume all risks.

A limited number of companies deal in mortgages as a jobbing or merchandise business. The mortgages generally are sold after suitable investors have been found. A few of these companies retain ownership in a portion of the mortgages, deposit them with a trust company, and issue debentures secured by the mortgages as well as by the capital of the company. The debentures are issued in even amounts of $100 and upward and for varying periods, affording the investor some of the usual conveniences of bonds. However, inasmuch as the purchaser of a debenture does not know the particular mortgages used as security he must rely on the integrity and solvency of the company to protect his investment.

The students of rural credit recognize the desirability of another piece of legislation which may probably be had at the hands of the several States or of the Federal Government, namely, legislation authorizing and encouraging local personal cooperative credit associations. Some States have already taken steps in this direction and others are contemplating taking them. The Department of Agriculture has made earnest investigations in this field and is in position to offer suggestions as to legislation and as to the form and operations of rural credit cooperative associations. Such associations as these will perhaps render their largest service in the sections of the country where there are many small farmers whose individual resources may not be sufficient to enable them to secure the requisite credit. Their largest field for operation would probably be the South. Characteristics of such associations of small farmers are: Unlimited liability of members, the pledging of the faith of each to the other and of the whole to the lender; the use of funds for clearly defined productive purposes; and the supervision by the association of the use made of the funds. It has been objected that the feature of unlimited liability will prevent the organization of such associations in this country, but in certain sections of the country the liability of small farmers is already unlimited, and this could not be said to be an insurmountable obstacle.

In reference to such proposed associations, as well as to land-mortgage banks, it is of the utmost importance that attention be centered on the use which may be made of borrowed money. It is of high importance that there should be guaranties of the use of funds secured for productive purposes on the farms covered by mortgages or other obligations; otherwise, the field for speculation will be

opened and more harm than good may result. The investigations of the department indicate that a relatively small number of the banks of the country pay any attention whatever to the purposes for which loans are made, and in replies to inquiries many of the banks reporting did not even attempt to give data bearing on this important point.

The Office of Markets and Rural Organization has continued its investigation into the field of personal credits. From data gathered it appears that the State, private, and savings banks and trust companies supply approximately $1,000,000,000 for short-time loans to farmers and that national banks furnish $750,000,000. As may be expected, because of the differences in the relative importance of agriculture in various States, these short-time loans are very unevenly distributed. The funds are used chiefly in the financing of cattle raising, feeding, and marketing, of dairying, of hog and sheep raising, and of grain and cotton growing and marketing.

GOOD ROADS.

Good roads are equally intimately related to both the production and the distribution of farm products. They are prerequisite not only to economical production and distribution but also to the promotion of the broader life of the communities. The great need, obviously, is for roads which shall get products from the farm to the nearest railway station, enabling the farmer to haul when he can not sow and reap, and to haul at a lower rate, to transport his children to consolidated schools, and to enjoy comfortably his social enterprises. The railway will continue for an indefinite time to be the nation's highway. Emphasis is needed on the community road. It is estimated that it costs 23 cents under existing conditions to haul a ton a mile on the average country road, and that this could be reduced by one-half if the roads were improved. The problem is partly, of course, one of funds, but even more largely one of methods, of instrumentalities, and of administration. The United States to-day is spending annually the equivalent of the huge sum of $200,000,000 for roads, an enormous increase in the last decade. Much of this is directed by local supervisors, and it is estimated by experts that of the amount so directed from 30 to 40 per cent is, relatively speaking, wasted or misdirected. Less than half the States have expert State highway commissions, and very few of them have any sort of expert local machinery.

The problem, so far as the Federal Government is concerned, is how to inject its assistance into the situation primarily so as to secure efficient expenditure. The people of the nation are intensely interested in this problem, and pressure will continue for action by the Federal Government. The matter is of sufficient importance to justify again an attempt to indicate the wise course of action in case the Federal Government is further to expand its activities and lend direct support. If direct Federal aid is to be expended, it should be done only under such conditions as will guarantee a dollar's results for every dollar of expenditure, and, as has been stated, the emphasis should be placed on the community road, on the necessity of improvement in an economical manner of the dirt roads of the country, particularly through the cheaper forms of construction, such as sand-clay, gravel, and earth. Legislation should provide for cooperation between the Federal Government and the States, and that the State through an expert highway commission should be the lowest unit with which the Federal machinery should deal. If the Federal Government recognizes any other unit than the State highway commission, it will complicate the situation in those States where satisfactory developments have taken place and it will retard movements in the right direction in other communities. If, on the other hand, the law recognizes only a central highway commission it will strengthen the hands of those that now exist and secure the creation of such bodies in the 26 States that do not now have them. The mere creation of such bodies in every State would be a marked gain. The Federal department and the highway commission of each State should be empowered jointly to select the roads upon which the work is to be performed and to determine the manner and methods of constructing roads under projects mutually agreed upon previously.

It seems desirable that if Federal money is to be expended, it should be limited to construction projects and should not be used for maintenance, and, furthermore, because of the time required for the development of the requisite machinery and because of the difficulty of assumption by either jurisdiction of a large initial burden, the Federal appropriation should at first be relatively small.

Expenditure for maintenance would involve the Government in a very unsafe and uncertain course. It would be a continuing appropriation on a vast scale. It would seem only proper that if roads are secured, the States and the communities should maintain them. I clearly recognize that it is difficult to draw the line between con-

struction and maintenance on the simpler forms of road; but, after all, the line can be drawn and would be much clearer if proper methods of construction were pursued.

As an automatic check to a drain on the Federal Treasury in case Federal aid is extended, provision should be made that each State shall make available for construction at least as much as is set aside by the Federal Government, preferably twice as much, and that it shall give a satisfactory guaranty to maintain the roads constructed. On all projects on which Federal money may be expended in cooperation with the States it should be provided that the two authorities shall fully cooperate, and that before Federal money is made available for any projects such projects shall have been mutually agreed upon by the Federal department and the State authorities, with clear understandings as to methods of construction, specifications, materials, and the development of a road system.

It will be objected by some that this suggestion involves an invasion of State rights. As a matter of fact, it simply looks to the use of Federal money for the purpose for which it may be voted, and to its efficient expenditure. Those who fear invasion of State rights can easily obviate the danger by declining to ask for Federal money. If they demand Federal money, they can not easily decline to have its proper and efficient expenditure safeguarded. It is no argument to assert that State agencies may be trusted. As a matter of fact, they are not the officials who have to assume the responsibility for the expenditure of Federal money. We do trust State authorities fully to vote and expend State funds. They assert the right to look after the expenditure of State funds and do so with great jealousy. They should show a willingness to have the Federal officers assist in the supervision of the expenditure of Federal moneys.

One thought should be clearly held in mind, namely, that it is highly unwise to discourage State and local effort. Only in recent years have the States begun seriously to attack many of the problems which it was originally contemplated they should solve. If the Federal Government were to make a very large appropriation, it is not improbable that the States would begin to look to it somewhat exclusively for funds with which to build roads. Such a development would be calamitous.

DISSEMINATING INFORMATION.

The nation is spending through the department large sums in acquiring agricultural information. It would be little short of

criminal to spend millions of dollars to acquire information and not to use every possible efficient agency available for placing it at the disposal of the people as promptly as possible, for it is certain that if the average farmer could be induced to apply what the experts now know or what the best farmers practice, a revolution could be brought about in the agriculture of the nation. It has seemed a matter of great urgency that through every proper channel at the earliest possible moment there be brought home to the 6,000,000 farm families of the Union the knowledge which the department has acquired and is increasingly acquiring. It is the purpose of the department, with as little delay as possible, through every proper medium to give the knowledge which the department possesses as the result of investigations and field work to all the people who desire it or should have it.

Up to a comparatively short time ago the printed matter conveying information was in the form of bulletins and circulars limited to issues of from 2,000 to 40,000 copies. Not infrequently much time was required for the final preparation of the bulletin, for its printing, and for its distribution. In the nature of things, the bulletins could not reach a great mass of the farmers. Many farmers did not even know of the existence of the department and knew nothing of the service it could render. They did not know of the existence of bulletins which would be helpful to them or how to secure them; and in many cases they could secure them only with considerable inconvenience and some expense. Furthermore, the bulletins were not infrequently difficult to interpret, to understand, and to apply. Emergencies frequently arise in which information, to be of value, must be placed within a few hours in the hands of farmers. The delay in issuing official printed bulletins and mailing them often defeated the possibility of service. In case of distant States the mailing time to and from Washington caused from 12 to 14 days to elapse before the desired information could be delivered. In many cases, where the department's supply of printed publications was exhausted, it has been necessary to inform the farmer that he must send 5 or 10 cents to the Superintendent of Documents to obtain the desired publications. This involves on the farmer's part the writing of a second letter to the Superintendent of Documents and another delay of 12 or 14 days. In cases actually worked out, where the publication desired was not available from the department, farmers in Pacific Coast States have been unable to obtain the information in less than 30 days.

As the result of long observation, as well as of careful survey, the department reached the conclusion that, aside from the conveying of information by competent persons directly to farmers on their farms, the most efficient medium for reaching the farmers was the agricultural press, and that, next to this, the most efficient mediums were the daily and weekly newspapers which devoted space to agricultural matters. It was ascertained that these journals would gladly use material if it were furnished to them in such form as to be readily available. It seemed desirable to have an office which could do this, because through it the matter could be more accurately and adequately presented. It was also discovered that correspondents of representative journals would telegraph to their home offices items giving important and timely agricultural information bearing upon pressing problems.

This whole matter was made the subject of a conference with the chiefs of bureaus, other officers of the department, and experienced writers and journalists. As a result of this conference the Office of Information was established.

Not only has the establishment of this Office of Information resulted in a fuller knowledge on the part of the farmers of the fact that they can get assistance and that bulletins are available, but it has led to a much larger call for bulletins and supplied a vast amount of information to the press.

During the fiscal years 1913 and 1914 the staff of the office prepared and issued in mimeographed form to the agricultural press and newspapers 512 summaries or condensed statements of fact and 30 special items to the press associations covering quarantine notices and supplementary statements regarding crop estimates. In addition, each week from 10 to 20 pages of typewritten material have been prepared specially and supplied to rural weekly papers. In every case the summary was circulated only to editors in the geographic or agricultural territory to which the information was directly applicable. The office also cooperates with many editors or their representatives, and others who write, or telephone, or call in person for special information needed by them in the preparation of agricultural articles. It answers daily many letters requesting information not covered directly by existing publications or not falling within the province of any one of the department's bureaus or offices.

While no effort has been made to keep a complete account of the use of material by publications, a computation of the circulation shows that the information issued through the office is appear-

ing monthly in over 250,000,000 printed pages. This computation does not include the total circulation of this information. It does not include the department's material which appears in the pages of nearly every agricultural journal and much special material on practical farming carried by weekly country papers. As a result of this service many daily papers which heretofore had given no attention to agriculture are now devoting considerable space to publishing the department's brief, simple statements of direct local value as to improved methods of farming or as to control of crop pests. These reach the farmers promptly through the Rural Free Delivery Service. This service is not now being used and never has been used for private interests, either directly or indirectly. It limits itself to the dissemination of established facts and of officially approved information. It has refrained from discussing individuals, from entering into controversies, and from commenting on legislation. It has the simple aim of attempting to convey to the farmers, through the press, as effectively and quickly as possible, the latest discoveries in agricultural science and the best practices.

COOPERATIVE EXTENSION ACT.

But bulletins, circulars, and press notices conveying information for farmers, no matter how excellent they may be and how numerous, will not solve the problem of reaching the farmer and of inducing him to adopt the best methods. Personal contact in this field of education, as in others, is essential. The method of demonstration by competent individuals to farmers on their farms has been tested by the department over many years. It has been justified by its results and has been formally sanctioned by Congress in the recent Agricultural Extension Act. This measure is of vast significance. It is one of the most striking educational measures ever adopted by any Government. It recognizes a new class of students—a class composed of men and women working at their daily tasks on the farm. The Federal and State Governments take the adult farmer and farm woman, as well as the farm boy and the farm girl, as their pupils. The measure provides for cooperation between the States and the Federal Government. It guarantees a coordination of the forces of the two jurisdictions. It places the brains of the two great agencies in conjunction, eliminates waste and friction, and insures efficiency. Providing for an initial appropriation of $10,000 to each State, to be expended through the land-grant colleges in cooperation with the Federal Department of Agriculture,

it stipulates that the amount shall increase by approximately a half million dollars from the Federal Treasury each year until 1921–22, and that each State accepting the act shall appropriate an amount equal to the increase above $10,000. The result will be that for the fiscal year 1922–23 and thereafter there will be expended, without any further legislation, from the Federal Treasury $4,580,000, and from the State treasuries $4,100,000, or a total of $8,680,000. This sum must be expended in direct instruction in the field, as the act is very specific in prohibiting its use for teaching or erecting buildings at institutions and in limiting the proportion that can be expended in printing bulletins. If we add to this fund the direct appropriations to the department for educational extension work and the excess appropriations of the several States, it probably will be found that the nation will be expending in 1922–23 and thereafter, without any further legislation, a sum in excess of $10,000,000 or $11,000,000.

Every State in the Union through its proper authority has accepted the provisions of the act. Most of the colleges have already submitted their projects for the current year and are laying the foundations of machinery which will be adequate to the handling of this great task. This piece of legislation will do more than provide effective machinery for efficiently reaching the farmer. It will greatly improve the relations between the institutions of the several States and the Federal department. It will promote harmony between them and will lead to wiser planning of work.

Believing that the provision for the coordination of work under the extension act was wise, and realizing that it was desirable to have only one piece of machinery in each State undertake this sort of task, the department suggested to the several State establishments the advantage of coordinating with the work under the extension act the extension work for which the department is directly responsible through its special appropriations. This suggestion was received with favor by the State institutions, and in every State except two or three this further coordination has been brought about, and thus the two great agencies are working in each State in full accord and harmony for the interest of the whole people.

FORESTRY PROBLEMS.

While the chief task of the department in forestry is the administration of the National Forests, its work has a larger aspect. Most of the country's timber is in private hands. Here the situation is far from satisfactory. Very little private timber is handled with a

view to the production of a new crop. Lumbering now involves much waste, partly because of the limited market for the lower grades. In spite of the growing sentiment against forest fires, and the spread of organized fire protection, there is still a heavy fire loss. Altogether, our timber resources are undergoing both depletion and dissipation, notwithstanding the generally recognized need for conserving what we have and for producing a new crop. It is as much the duty of the department to seek means of success in the growing of this crop as of any other.

That forestry can be practiced in this country with good results the experience of the department in managing the National Forests makes clear. The main difficulty in the way of private forestry can no longer be held to be the lack of adequate knowledge or of successful example. Unquestionably the existing situation is brought about by various causes, some of which are due to unchangeable economic conditions, while others are probably removable. There is great need for a careful inquiry to ascertain just what and how important these various causes are. Such an inquiry has been inaugurated jointly by the Department of Agriculture and the Department of Commerce. Its purpose is to obtain the basis for a constructive public policy with regard to the timber question in all its phases—present conditions of production and marketing, the effects of timber speculation and the danger of private monopoly control, waste, the effects of competition, the various elements which enter into the cost of lumber to the consumer, and the question of future supplies.

An important part of the forest problem is to get the right line drawn between farm and forest. Under private ownership, considerations enter which do not always lead to the best use of the land. On the National Forests the question is determined by a careful study of what the land is best fitted to produce and what the public most needs. Agricultural development is provided for either by excluding from the forests land chiefly valuable for other than forest purposes or by listing land for settlement under the Forest Homestead Act. The work is carried out through land classification, which was aggressively pushed last year. The elimination made or determined upon totaled over 2,000,000 acres, while systematic classification was conducted on 100 of the forests and over 280,000 acres of land were listed for settlement under the Forest Homestead Law. The area in the forests at the close of the year, exclusive of land not the property of the Government, was slightly over 165,000,000 acres.

There is need for similar classification work outside of the National Forests wherever the public domain is timbered. There are still many areas which should be added to the forests. Wherever the land will have largest permanent value through use for forest production, it should be held in public ownership. Timbered portions of the public domain are now unprotected against fire and trespass and are often a source of danger to adjacent lands. Under existing law, the President has, in the seven States of California, Oregon, Washington, Idaho, Montana, Colorado, and Wyoming, no authority to add such lands to the present National Forests. Legislative provision should be made for applying the classification principles in these States.

There is also need for legislation to permit the consolidation of National Forest holdings through land exchanges with States and private owners. Some of the forests contain a great deal of land which was acquired from the Government before the forests were established. Exchanges of land on the basis of equal values would be very advantageous to the Government, since the cost of administration and protection would be materially reduced.

The National Forests, of an immense property value, must first of all be safeguarded against destroying agencies. Their most serious menace is fire, though heavy losses may also result from the ravages of insect pests and tree diseases. The control of all these grows yearly more efficient. A most dangerous fire season has just been concluded with remarkable results. A drought of unusual severity and duration created tinderlike conditions throughout most of the Northwest. To this was added at times the peril of high winds, which greatly increased the difficulty of fire control. That the season was terminated without an appalling destruction of both public and private property in and about the National Forests is due to the preparedness of the Forest Service organization, the yearly expanding equipment of the forests with means of communication and movement of both men and supplies, and the aggressiveness with which the fires were fought before they had time to develop.

It is beyond question that the cost of discovering and fighting these fires was repaid many times over. A billion dollars' worth of Government timber—to say nothing of other resources, of private property, and of human life—was brought through the season with a comparatively trifling loss. To achieve this result it was necessary for the department to create a large deficiency, since the appropriation for emergency fire fighting was wholly inadequate. In

consequence a deficiency appropriation must be asked from Congress.

A larger emergency fund is needed. In the summer of 1910 unprecedented fires resulted in a deficiency which Congress met by an appropriation of $900,000. To prevent such a contingency from arising the following year an emergency fund of $1,000,000 was made available, to be drawn upon only in case of unusual need. This fund has been cut down in the successive appropriation acts since, until in the current year it has become only $100,000. Experience has made it plain that only in very favorable years is this amount adequate.

The administrative task which the National Forests present goes far beyond their protection. Use of their resources must be provided for under plans which aim at their systematic development.

Timber, forage, and water are the resources of primary importance. Their full development is possible only through accurate knowledge of the factors which control their yield and painstaking study of the methods which will secure the most complete use. Investigative work is the key which unlocks these resources for the public. Use of the National Forests is being developed along lines which are at once thoroughly scientific and thoroughly practical.

In its handling of timber sales on the National Forests the department is confronted with a situation radically different from that which obtains with respect to the grazing. While almost all the range on the forests is in demand, most of the timber is not. To a large extent, development work here means so handling the timber that it will be an important factor in opening up the country. Wherever and whenever general business and market conditions make it possible to sell large bodies of now inaccessible timber, the aim is to offer the timber on terms which will tend to increase transportation facilities, promote settlement, and build up permanent communities. Where timber can be sold, the benefits of Government management of the forests as public resources are apparent now. Where, however, the timber is not in present demand, a difficult situation sometimes exists.

It has been urged that, with the vast supplies of virgin National Forest timber, the Government should greatly increase its sales by lowering the price asked for stumpage. To the extent that such a course had any effect at all, it would be in the long run an effect unfavorable to the public interest. Upon the greater part of the timber it would have no effect, because no manufacturer could,

under present conditions, afford to cut the timber at any price. Where timber is thus not in demand because still inaccessible, as a rule the possibility of marketing it depends on the advent of a period of greater activity in the general lumber trade. When, as at the present time, lumbermen are forced by general market conditions to curtail output, the department can not expect to make many large sales. Nevertheless, it is wise even in such times not to cease offering large bodies of timber on terms which may attract purchasers, and this is being done. At the same time all possible effort is given to develop small sales for the supply of local needs, and sales to industries which require wood for special purposes, since sales of this character provide a fairly steady market for National Forest stumpage, even when the general market is depressed. In a word, the timber-sale policy, no less than the grazing-regulation policy, aims to make the resource serviceable to the public now, as well as in the future, in the fullest degree which scientific production and utilization can make possible.

FURTHER SPECIAL COMMUNITY AID.

In regions where timber is the chief income-producing resource, absence of demand for it often works a serious hardship upon those who have entered the region as the advance guard of civilization and are seeking, in the face of many difficulties, to establish homes. There are counties in which a sparse local population of pioneer settlers find themselves surrounded by a wilderness largely consisting of National Forest land, which is almost idle so far as any form of present use is concerned. In other words, a great, if not the greatest, potential source of wealth in such counties, held in trust by the Government for the benefit of the public, not merely contributes nothing now to the upbuilding of the communities which will give value to the forests, but actually adds to the burden which these communities must assume. Were the forests private property they would pay their fair proportion of the cost of road development, public schools, and other public activities, through taxation. The Government, unlike the private owner of timberland in such regions, is holding the timber, not in order to make a profit later by its advance in value, but in order to make it promote the public welfare. That it should be made to serve the local as well as the national public welfare has been definitely recognized in the provisions of law for the use of 35 per cent of all gross receipts from the forests for local public purposes.

To carry more fully into effect this already established principle a further step should be taken. It should not be necessary to wait until the period of hardest struggle is past before these public resources begin to assist local development. Before the National Forests begin to yield large incomes, as well as after, they should be made to participate in the work of building up the country and giving value to all its resources.

The first need of the public in undeveloped regions is for more and better roads. Without them the struggle of individuals to gain a foothold is much more difficult, while isolation from neighbors and the outside world means meager educational opportunity, a lack of comforts, and conditions unfavorable to community life. A road system, however, constitutes a capital investment which a handful of settlers must make a little at a time. When their roads must be built largely through National Forest lands, which pay no taxes, their case is much more difficult. In such regions the Secretary of Agriculture should be authorized to make a study of the local conditions and to gather all the data necessary to formulate a plan for public-road development based on local needs. These plans should be carried into sufficient detail to provide a reasonably accurate estimate of the cost of the road construction which it is proposed that the Government shall undertake. They should be accompanied by careful and conservative appraisals of the value of the National Forest timber in each locality and a forecast of the future income which the forests will bring in from all sources. On the basis of the showings of fact regarding the value of the Government's property, its potential income-yielding capacity, and the needs of the public, Congress should be asked to appropriate for the construction of specific projects recommended by the Secretary of Agriculture. The cost of such road construction by the Government should constitute an advance of the amounts which the forests would later make available for local use. In effect, therefore, the roads would become an obligation upon the forests, to be extinguished as their resources come into commercial demand.

Water is a National Forest resource of even greater importance than timber or range, for the forests feed every important western stream. Water supplies and the value of water use depend to a large extent on the methods employed in handling the timber and forage resources, for both the volume and the purity of the water yield may be disastrously impaired by bad forestry or grazing

methods. Of all forms of water use, that which supplies municipal needs should be given most careful consideration. Some 1,200 western towns derive their water from National Forest watersheds. The authority of the Secretary of Agriculture to protect such water from contamination is inadequate to safeguard the public health, and should be enlarged by further legislation.

Recreational use of the forests is by far the chief of what may be called their secondary uses, and is certain to grow rapidly in importance. While water, wood, and forage production must be given first place, constructive study of the problems which the value of the forests for recreational use present is also an urgent need. Among these problems is provision for the use of land by persons wishing to build summer homes within the forests, and by hotel enterprises. At present the only course open to the department is to grant applicants for such privileges a revocable permit to occupy the necessary land. Provision for term leases is highly desirable, and legislation to this end is urged.

REORGANIZATION.

The Congress at its last session authorized and directed the Secretary of Agriculture "to prepare a plan for reorganizing, redirecting, and systematizing the work of the Department of Agriculture as the interests of economical and efficient administration may require." It ordered that such plan be submitted to Congress in the Book of Estimates for the fiscal year 1916, and that the estimates of expenditures of the department for the fiscal year 1916 shall be prepared and submitted in accordance therewith. In compliance with this authorization and direction, a careful survey has been made of the organization and work of the entire department. It was evident from the outset that in the rapid growth of the department some lines of work had been located illogically in different bureaus out of immediate touch with closer related lines and, in some instances, without any reference to the adequacy of the machinery of the bureau to handle them. Furthermore, it was apparent that the three leading lines of department work—the regulatory, the research, and the educational—had become in a measure intermingled in the various bureaus, so that no satisfactorily clear view could be had of them in their entirety either in any bureau or in the department as a whole. It was obvious that some work was done at cross-purposes and that a certain amount of conflict of interest, lost motion, and inefficiency resulted. It is clearly desirable, as far as possible, to differentiate and

segregate each kind of work from the other, to see to it that the policing or regulatory functions do not interfere with the research work, or either of these with the educational or extension work, but that, on the other hand, they are so organized and related that each would reenforce and foster the other. A committee consisting of officers drawn from various bureaus made a careful study of the situation and submitted its report, which, after revision, was approved by the Secretary and will be reported to the Congress for its sanction. The estimates of the department have been submitted in accordance with the plan, as directed by the Congress.

The first important feature of the proposed change is the definite outline or segregation in each bureau of these three groups of activities—the regulatory, the research, and the extension. The conclusion was reached that it was not only not necessary to interfere with the bureau and office organizations existing, but that it would be distinctly unwise to do so. The suggestion of grouping the services of the department as a whole, according to the purposes in view, into regulatory, research, extension, and other groups, each with a large number of similar small units, was carefully considered and was abandoned as unnecessary and undesirable. It was decided that better results would be secured by retaining the existing organizations, with certain modifications and rearrangements.

This segregation, however, which is highly important, is a matter of internal concern and in the interests of administrative efficiency, and requires no legislative action. The work will be shaped in conformity to the segregation, and the administrative officers will have a clearer view of the several activities under their direction. Pains will be taken to assign those who have research talent to the investigational work, those who have administrative ability to the regulatory, and those who have special talent for the direction of extension work to that entirely. The changes in these directions can not fail to be conducive to efficiency.

The second and equally important suggested change is the relocation of important lines of work, as follows:

It is proposed to remove from the Bureau of Plant Industry the Office of Farm Management and the farm-demonstration work for both the North and the South, and to attach the former to the Office of the Secretary and the latter to the Office of Experiment Stations, the name of which it is proposed to change to the States Relations Service. Farm Management conceives the farm as a

whole. Its problem is not primarily a Plant Industry problem. It is rather a business or economic problem. It is not one for which the agronomist has necessarily the requisite training, although the service of the agronomist as well as the services of experts of other bureaus are invoked. Since its function is that of studying the farm from the business point of view in all its aspects, it seemed advisable to relate the office to that of the Secretary, so that the officers might feel conscious of no bureau limitations. Similar considerations led to the conclusion that the farm-demonstration work should not be attached to a particular bureau. Heretofore, the agents in this work, attached as they have been to the Bureau of Plant Industry, have experienced some embarrassment in demonstrating things coming within the work of other bureaus. Obviously the farm demonstrator must be prepared to demonstrate anything the department has of value to the farmer. He can not conceive of the farm partially. The change in the name of the Office of Experiment Stations to States Relations Service is proposed because the term "Office of Experiment Stations" is no longer indicative of that part of the department's activities. That office has in addition to the supervision of the experiment-station funds the supervision of other funds expended by the land-grant colleges, and has logically been charged with the administration of the new extension act. The direct farm-demonstration work is similar to the work which will be carried on under the extension act, and, as has been stated, arrangements have been made for coordinating it with the work under the extension act.

It is proposed to change the name of the Office of Public Roads to the Office of Public Roads and Rural Engineering, to eliminate from the Office of Experiment Stations the work in irrigation and drainage, and from the Bureau of Plant Industry the work in rural architecture, and to locate these three lines of work in the newly named office. There seems not to have been any logical reason for locating the work in irrigation and drainage in the Office of Experiment Stations, and that office in its higher administrative branches is not organized with a view to the direction of engineering work. The Office of Public Roads is primarily an engineering office, and irrigation and drainage, as well as architecture, naturally belong to it. To the new Office of Markets and Rural Organization it is proposed to transfer from the Bureau of Plant Industry the work in farm-credit and farm-insurance investigation; from the Bureau of Animal

Industry the market-milk investigations, and, in part, in cooperation with the Bureau of Animal Industry and Bureau of Chemistry, the poultry and egg investigations.

It is proposed to transfer from the Bureau of Soils to the Bureau of Plant Industry the soil-fertility investigations. The committee of experts reporting on this matter were unanimous that the work in soil-fertility investigations and that in soil bacteriology and in plant pathology in the Bureau of Plant Industry should be located in the same bureau. They are closely related, and work in one could not in all cases be carried to a satisfactory conclusion without a close and intimate coordination with the others. After a most careful consideration it seemed wise and practicable to propose that the transfer be made to the Bureau of Plant Industry. Other less important changes include the transfer of poisonous-plant investigations from the Bureau of Plant Industry to the Bureau of Animal Industry, investigations of duck diseases from the Biological Survey to the Bureau of Animal Industry, and of wood-distillation work from the Bureau of Chemistry to the Forest Service.

There is good reason for believing that the redirection and relocation of the work as proposed will result in a marked increase in the efficiency of the labors of the department.

CONCLUSION.

I have sought to bring into view in the main some of the larger constructive tasks and proposals of this department. I have not undertaken to review the work and services of certain great offices of the department, such as the Weather Bureau, which is giving highly valuable aid not only to the farmer, to the business man, and to the navigator, but to all the people of the nation; the Office of Experiment Stations, which has such broad and intimate relations with the whole land-grant educational machinery of the nation; the Bureau of Chemistry, which is charged with the administration of the Food and Drugs Act; the Bureau of Biological Survey, which is intrusted with many difficult tasks, including the administration of the Migratory-Bird Law; the Bureau of Soils; the special boards, such as the Federal Horticultural Board and the Insecticide and Fungicide Board; and the Office of the Solicitor, whose activities are essential to the orderly handling of many important departmental, legislative, and administrative affairs. I have not attempted to outline the activities of divisions of these or of other offices and bureaus. I should deeply regret it if my failure to do so were interpreted to indicate that their

work is in any measure less valuable and helpful than that which has received more specific and elaborate mention. Where activities are so varied, the task must of necessity be one of selection and emphasis. For a full comprehension of the undertakings, activities, and services of the department the reports of the several bureaus and offices separately published must be consulted.

Through such legislation, enterprises, and labors the Federal Government is attempting to solve the problems of agriculture and of rural life. It finds valuable allies and coworkers in the great agricultural agencies of the several States. Nothing short of a comprehensive attempt to make rural life profitable, healthful, comfortable, and attractive will solve the problems. It is the only sure way of retaining in the rural districts an adequate number of efficient and contented people. That the thought and effort of the nation must be persistently and systematically along these lines is clear. The urgency of the task is emphasized by the fact that while the population of the United States in the last 15 years has increased 23,000,000, the strictly rural districts have shown an increase of perhaps less than 6,000,000. While we labor to increase the supply of material things we can not neglect the higher things—the intellectual and social sides of rural life. The conservation and development of the people is the greatest problem of conservation confronting us. We must see to it that some of the finer results of civilization accrue to the people of the rural districts and are not the peculiar possession of urban communities. An expenditure of effort and money in this direction can not be a burden. Through such measures wisely executed and with such protection rural life will become more efficient, and the farmers of the nation may without fear face the competition of the world.

Respectfully,

D. F. HOUSTON,
Secretary of Agriculture.

The PRESIDENT.

REPORTS OF CHIEFS.

REPORT OF THE CHIEF OF THE WEATHER BUREAU.

UNITED STATES DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
Washington, D. C., September 21, 1914.

SIR: I have the honor to submit a report of the operations of the Weather Bureau during the fiscal year ended June 30, 1914.

Respectfully,

C. F. MARVIN,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

The last year has been comparatively free from severe storms or floods such as sometimes occur. A destructive storm passed over the Great Lakes early in November, 1913, causing heavy loss of life and shipping, especially on Lakes Huron and Erie. Also in the Southwest the heavy rains of December, 1913, falling upon a soil already saturated, caused severe and in some cases unprecedented floods in the rivers of Texas.

A number of changes, mostly of a minor character, have been effected in the work of the bureau for the purpose of improving and extending the service or securing greater economies of administration. The several classes of its work are briefly discussed under separate topics, as follows:

STATIONS AND OBSERVATIONS.

The fully equipped stations of the bureau reporting telegraphically once or twice each day are maintained primarily for forecasting and storm-warning purposes, and the existing stations of this character within the immediate confines of the United States serve practically all existing needs. Extensions are necessary within Alaska, the Canal Zone, and the regions of the Caribbean Sea, but these can be made only when additional funds are provided, which will be made the subject of estimates at the proper time.

A number of new minor stations were established during the year at points not hitherto represented, and extensions have been made in special fields from which prompt information regarding weather conditions was desirable.

A new special service for reporting the daily weather conditions over the principal range region of the West, as affecting the live-stock interests, was inaugurated in the spring of 1914. Reports from a number of points in the western Great Plains region are collected daily by telegraph at Amarillo, Tex., and thence distributed in bulletin form to the cattle and financial interests of the surrounding country. This service has elicited much approval.

Action was taken during the year to improve the instrumental equipment exposure at the cooperative meteorological stations, especially those established in the sparsely settled districts of the more western States.

WATER RESOURCES DETERMINED BY SNOW SURVEYS.

The work of determining the water content of the blanket of snow which remains on the ground at high altitudes in some of the Western States, inaugurated in Utah a few years ago, was extended during 1913–14 into one watershed each in the States of Idaho and Nevada.

Intensive snow surveys for the country in general are not possible with the means available. The bureau is seeking, however, to increase the amount of useful information with respect to the amount of water that will be available from melting snow, through the more general use of a new form of snow scale or stake that can be permanently installed in places that are not easily accessible in the snow season, but which can be visited shortly before the melting season begins. The observations of snow depths obtained by use of these snow stakes, when supplemented by a relatively small number of density measurements, afford the best information concerning the season's water supply from the snow fields of high altitudes that can be obtained short of very laborious and expensive surveys.

Some field work has been done in Arizona on the headwaters of the Salt River, whence comes a large part of the water that supplies the Roosevelt Reservoir. In general, the installation of permanent snow stakes in the higher altitudes, although progressing slowly, is but the beginning of a campaign in the interest of water users that will eventually, it is believed, yield information of the highest importance.

OBSERVATORY BUILDINGS.

Work on the new observatory buildings authorized by Congress for Cincinnati, Ohio, and Sandy Hook, N. J., has progressed favorably. At Cincinnati some delay was experienced in obtaining a site. A very satisfactory location was finally purchased on Lafayette Circle, Clifton suburb. At Sandy Hook a very acceptable site has been obtained on ground closely adjacent to the Fort Hancock military reservation through the courtesy of the War Department. Both buildings are to be brick, and of good, substantial character.

TELEGRAPH SERVICE.

Except for temporary interruptions, the several sections of the Weather Bureau telegraph and telephone lines were in continuous operation during the year.

FORECASTS AND WARNINGS.

During the year reports from Spitzbergen (lat., 78° N.; long., 20° E., approximately) were received by telegraph for the first time. These formed a valuable addition to the telegraphic weather reports from northern Europe and Asia. Wireless reports from newly established stations—Swan Islands (lat., 17½° N.; long., 84° W., approximately) and Cape San Antonio (on the extreme western end of the island of Cuba)—materially aid the forecast official in locating and forecasting the movement of storms of subtropical origin in the Caribbean Sea.

For several years the forecasters at the central office have prepared each day a manuscript weather map of the entire Northern Hemisphere. In view of the great value of such a map, it was deemed advisable to undertake its daily publication in the hope that by placing it in the hands of many meteorologists and scientists, both at home and abroad, the serious scientific and mathematical study of the great and complex problems of the general circulation of the atmosphere would be materially facilitated. This publication was begun January 1, 1914, and elicited numerous expressions of enthusiasm from eminent meteorologists of the United States and Europe. Unfortunately the complete suspension of the telegraphic transmission of the foreign reports with the opening of hostilities in the European countries, beginning July 31, prevented the further issue of this valuable record of atmospheric conditions.

Better data for forecasting frosts for the citrus districts are now available from new reporting stations in California and Florida. These will result in improving the methods of utilizing and distributing the warnings. The new stations are in orchards, and the temperatures reported are those to which the trees and fruits are exposed. This gives the forecaster definite information of conditions in the orchards. In the Rogue River and Yakima Valleys and the Boise (Idaho) Basin the bureau has observers on the ground during the frost season who amplify the district forecasts and apply them specifically to restricted neighborhoods. When growers make preparations to protect their orchards by modern artificial methods of heating or otherwise, the frost forecasts become indispensable. The plan in these localities is to have a number of substations equipped with thermometers and rain gauges, the local observer making daily report to the forecaster.

A new service is just being inaugurated whereby warnings will be issued during the summer of the coming of hot dry winds in the valuable timbered regions of the West—that is, warnings of atmospheric conditions that are peculiarly favorable to the inception and spread of forest fires. The forecasting of these winds is as yet tentative and experimental, and the final practicability of the service is yet to be established.

Through cooperation with the naval radio service of the Navy Department, a daily distribution of wind forecasts and storm warnings is now regularly made from two points—Radio, Va., and Key West, Fla.—for the Gulf of Mexico and the western portion of the Atlantic Ocean. During the year arrangements were completed to have a similar service for the Great Lakes. By this means valuable information is placed in the hands of vessel masters while at sea.

The study of meteorological data with a view to increasing the percentage of accuracy of the daily and the weekly forecasts, and, if possible, extending the forecast period beyond one week, will be continued.

Two notable contributions to the technical forecasting work of the service are now far advanced toward completion. The first is a study by Messrs. E. H. Bowie and R. H. Weightman, resulting in a system of normals showing the mean 24-hour movements by 5-degree squares of storms in the United States, classified into 9 types. This was completed during the year and will shortly be published as a supplement to the Monthly Weather Review. The second is a series of essays on weather forecasting by a large number of the best and most experienced forecasters of the Weather Bureau. These are now in the hands of a competent editor in chief, with advisory assistants, for the preparation of a handbook or manual on weather forecasting in the United States, to serve as a textbook and guide to all the men in the service desiring to qualify and become proficient in forecasting.

RIVER AND FLOOD SERVICE.

The occupation of agricultural lands and the building of towns and cities along the river bottoms of Oklahoma within the last 20 years has made it necessary to establish a flood-warning service on the principal rivers of that State. Such a service was completed on April 15, 1914, in time, fortunately, to give ample warning of a destructive flood that swept down the Canadian River during the first week of May, 1914.

Minor changes have been made in the Columbus, Ohio, Cairo, Ill., and Houston, Tex., districts, with a view to improving the distribution of flood warnings.

The absence of destructive storms and floods generally has already been mentioned. The severe and in some cases unprecedented floods in the rivers of Texas in December, 1913, however, caused a loss of 177 human lives and a property loss of approximately eight and a half millions of dollars.

The plan of reducing to writing the knowledge gained by the several officials of the bureau in the forecasting of floods has been continued during the year, and rules for the preparation of flood forecasts for the Mississippi at St. Louis and for the Susquehanna at Williamsport and Harrisburg, Pa., have been completed and put into practical use. These rules are useful not only in the daily work of the station, but also serve the purpose of preserving and transmitting to others the methods of the most successful flood forecasters.

In its hydrographic work the Weather Bureau cooperates with other branches of the public service whenever it is practicable to do so; thus, if the gaging of a stream at any point is helpful to another department, the expense of the upkeep is shared with that department. Mutually helpful working arrangements are in force with the United States Engineers, the Mississippi River Commission, the Water Resources Branch of the Geological Survey, the Reclamation Service, the Indian Office, and the Forest Service of the Department of Agriculture.

METEOROLOGICAL RECORDS AND PUBLICATIONS.

The customary serial and other publications of the bureau were issued during the year. Bulletin Y, The Ohio and Mississippi Floods of 1912, by H. C. Frankenfield, and Bulletin Z, The Floods in the Rivers of the Ohio and Lower Mississippi Valleys, by Alfred J. Henry, complete the lettered series of bulletins of the Weather Bureau heretofore published in quarto form. Material of this character will be printed hereafter as supplements to the Monthly Weather Review.

The demand for Weather Bureau literature, especially from schools and colleges and from foreign applicants, has been very large and bears witness to the constantly growing appreciation of the work of the bureau on the part of students, scientists, and the general public.

CHANGES IN SERIAL PUBLICATIONS.—The compilation of climatological data for reference study and publications went forward as usual during the year.

In response to a general desire for the presentation of climatological data by States rather than by large drainage areas, the publication of such data by State units was resumed. This change went into effect with the issue of climatological data by State units for January, 1914. At the same time the Monthly Weather Review was restored to its form of the period prior to July 1, 1909, which was essentially that of a meteorological journal, and the so-called Bulletin of the Mount Weather Observatory, upon the completion of volume 6, was consolidated with the Monthly Weather Review.

The scope of the national weather bulletin was enlarged during the year by the introduction of information regarding the progress of crop growth and development. The form of the bulletin was also changed from that of a single large sheet to a pamphlet, quarto size, and its value further increased by the addition of diagrams showing for preceding weeks the temperature and precipitation conditions and comparison with normal value over principal crop-growing areas. The diagram also contained data showing the condition of the principal crops from month to month as furnished by the Bureau of Statistics (Crop Estimates).

In October, 1913, the Weather Bureau, in cooperation with the Bureau of Statistics, began publishing monthly summaries of condition of the various crops for each State in the Union. These summaries have been telegraphed monthly from the Bureau of Statistics in Washington to the several State centers of the Weather Bureau, where they are promptly printed and distributed to the press and public.

A further dissemination of weather and crop information each week has been inaugurated by telegraphing in condensed form a summary of the more important matters appearing each Tuesday in the weekly bulletin to the corn and wheat and cotton region centers distributing daily bulletins. These summaries are printed at the various stations receiving them and are promptly distributed.

Considerable work was accomplished during the year, in cooperation with the Bureau of Plant Industry, in certain investigations being carried forward by that bureau, concerning the relation of

farm enterprises to geographical factors. This bureau has assisted in the work by compiling and checking a large amount of the climatological data, particularly records of precipitation and frost.

LIBRARY.

Additions to the library during the year numbered 1,167 books and pamphlets, bringing the strength of the collection up to about 34,000.

The bureau is gradually building up a collection of the most important meteorological works, old and new, at its station in Chicago. These books are useful to the large staff of the Chicago station, and are also available for loan to other stations as needed.

The promotion examinations heretofore held under the direction of the librarian, as supervising examiner, in grammar, arithmetic, elementary meteorology, essay writing, algebra, and trigonometry were abolished in August, 1913. The examinations in physics, astronomy, and advanced meteorology were retained, but they are now required only of employees who desire advancement to the scientific grades of the service, while the examination in plant physiology is retained as an optional examination for employees desiring to undertake work in agricultural meteorology. The number of examination papers rated during the fiscal year was 55, of which 44, or 80 per cent, attained passing grades.

TECHNICAL STUDIES AND RESEARCH.

Aerial observations by means of kites and balloons and the measurement of solar radiation were continued as heretofore, chiefly at Mount Weather, although preparations were made for the transfer of this work to the Middle West.

The following extracts from the report of Prof. W. R. Blair, in charge of the aerial investigations, indicate the status of that work:

THE DIURNAL CONVECTIVE SYSTEM.—All observations made at Mount Weather and elsewhere in the study of this system have been summarized and published in the Bulletin of the Mount Weather Observatory, volume 6, part 5.

INTERNATIONAL COOPERATION.—During the year free-air observations were made on days selected by the International Commission. The data obtained in these observations have been sent to the commission for study and publication. All data obtained on "international days," not elsewhere published by us, will appear in the July, 1914, number of the Monthly Weather Review.

THE FIVE-YEAR SUMMARY.—This summary of the data obtained at Mount Weather in the five years ending June 30, 1912, has been completed and published in the Bulletin of the Mount Weather Observatory, volume 6, part 4.

MOUNTS WILSON AND WHITNEY EXPEDITION.—Preparations for this expedition were all complete in June, 1913. The observations were made in July and August of the same year. The Weather Bureau made aerial soundings with free balloons at Avalon, Cal., throughout the period from July 21 to August 12, and with captive balloons at the base and summit of Mount Whitney from August 2 to 13. In five of the soundings made at Avalon self-recording pyrheliometers, devised and constructed by C. G. Abbot, were carried up in addition to the meteorographs. While these soundings were in progress, the Smithsonian Institution was making observations of the total moisture content of the air above Mount Wilson; also of insolation and nocturnal radiation at Mount Wilson in the early part of the period, at Mount Whitney in the latter part. The records obtained by the pyrheliometers sent up have been discussed by Mr. Abbot in Science, March 6, 1914. The observations of insolation and of nocturnal radiation are being prepared for publication by A. K. Angström, under whose direction they were made. The data obtained in the aerial soundings

have been reduced and prepared for publication. They will appear in the July, 1914, number of the Monthly Weather Review.

TRANSFER OF AERIAL WORK TO THE MIDDLE WEST.—In order to increase the effectiveness of the aerological investigations by means of kites and balloons, steps were taken toward the close of the year to transfer this work from Mount Weather to a point in the Middle West, and the bureau was peculiarly fortunate in this connection in securing the temporary use of the valuable hydrogen generating and aeronautic equipment belonging to the Signal Corps of the Army, located at Fort Omaha, Nebr.

The request of the Secretary of Agriculture to utilize this elaborate plant was generously granted by the Secretary of War, May 11, 1914, and action was immediately taken to generate hydrogen for the purpose of making a large number of balloon ascensions, both for purely meteorological purposes and also in cooperation with the Astrophysical Observatory of the Smithsonian Institution, for the purpose of securing measurements of intensity of solar radiations at great elevations in the free air.

Incidental to the foregoing, search was made for the best possible site in the vicinity of Omaha for the location of a kite-flying station, but no selection was made before the close of the year.

The influence of the wind in lowering the barometer readings at Mount Weather was briefly studied, and certain quantitative results were obtained.

MEASUREMENT OF SOLAR RADIATION.—Certain general, rather definite, conclusions having been reached from the investigations of solar radiation, it appears appropriate to mention briefly some of these presented in the report of Prof. H. H. Kimball, in charge of this work.

The observations have been conducted not only at Mount Weather but also at Madison, Wis., Lincoln, Nebr., and Santa Fe, N. Mex. Some of the dust thrown into the atmosphere by the eruption of the Katmai Volcano, Alaska, early in June, 1912, still affected radiation intensities until about December, 1913, and air temperatures over the whole Northern Hemisphere seem to be appreciably lowered thereby.

From the extensive studies of total solar and sky radiation received by a horizontal surface it is found that on the average with the clearest sky the heat received per square centimeter varies from 250 calories per day on December 20 to 765 calories on June 10. On March 20 it is 605 calories, and on September 20 it is 510 calories. In general, the radiation received on clear days during the first half of the year exceeds that received on clear days during the second half by about 8 per cent. This is principally because of the increased water-vapor content of the atmosphere during the latter period.

The total radiation received with the clearest sky during an hour in the middle of the day varies from 45 calories per square centimeter of horizontal surface in December to somewhat over 90 calories in June. It exceeds 60 calories per hour, or 1 calorie per minute, from early in February to the middle of October. The maximum radiation per minute does not occur when the sky is clearest, but when there are clouds near the sun, which, while not obscuring it, reflect its rays toward the earth. A rate of 1 calorie per minute has been recorded in every month except December, a rate of 1.50 calories from early in April to early in September, and a rate of 1.65 calories in May and June.

The photometric measurements with the clearest sky give a midday intensity of 4,500 foot-candles in December and 9,500 foot-candles in June. About one-fourth of this illumination is received diffusely from the sky, while only about one-fifth the radiant heat received at noon is from this source.

Expressed in units of work, the receipt of 1 calorie of heat per minute per square centimeter of area represents 697 watts per square meter, or 0.78 horsepower per square yard; and 1.5 calories per minute, or 90 calories per hour, which is not an uncommon rate at midday in summer with a clear sky, represents over 1 kilowatt per square meter, or nearly 1.2 horsepower per square yard.

During the summer months at Mount Weather the average daily insolation is about 70 per cent of what would be received were the sky continuously clear.

A detailed study of these various radiation measurements has been prepared for publication in the Monthly Weather Review.

NOCTURNAL RADIATION.—Closely related to the subject of insolation, or the heat received by radiation, at the surface of the earth, is that of irradiation, or the heat lost by radiation from the earth outward. Measurements of the loss of heat from a blackened surface when freely exposed to the sky at night have been made at Mount Weather since May 14, 1914. The maximum rate measured is 0.22 calories per minute, or 13.2 calories per hour, which was obtained on a clear night early in June. The rate has been found to be very uniform during a clear night. Assuming that this rate is maintained during the day, the loss of heat by radiation during 24 hours of clear weather in June may reach 317 calories, or about 40 per cent of the insolation. The average nocturnal radiation during June was less than 60 per cent of this maximum rate, however, and fell off steadily as the water-vapor content of the atmosphere increased with the advance of summer.

REPORT OF THE CHIEF OF THE BUREAU OF ANIMAL INDUSTRY.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., September 26, 1914.

SIR: I have the honor to transmit herewith a report of the operations of the Bureau of Animal Industry for the fiscal year ended June 30, 1914.

Respectfully,

A. D. MELVIN,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

GENERAL STATEMENT.

The work of the Bureau of Animal Industry, dealing with the live-stock industry in its various aspects, remains of the same general character. It embraces administrative, regulatory, research, and educational features.

A development of the year was the addition to the bureau's duties of the inspection of imported meats as provided for in the tariff act approved October 3, 1913. In anticipation of this work the chief of the bureau, by direction of the Secretary, visited South America in August and September, 1913, to see whether the systems of meat inspection of Argentina and Uruguay, the principal South American meat-exporting countries, were adequate. Dr. E. C. Joss was likewise sent to Australia and New Zealand. The Governments of those countries showed a desire to conform to the requirements of the United States. Statistics of the inspection of meat imports are given in the part of this report dealing with the work of the Meat Inspection Division.

Revised meat-inspection regulations, which had been in preparation for some time, were issued soon after the close of the fiscal year, the portion relating to domestic meats to take effect November 1, 1914, and that pertaining to imported meats January 1, 1915.

Good progress was kept up during the year in the eradication of southern cattle ticks and of scabies of sheep and cattle, and a good beginning was made in demonstrating methods of combating hog cholera by the serum treatment.

The educational work in connection with the formation of boys' pig clubs and boys' and girls' poultry clubs, the production of infertile eggs of superior keeping qualities, the development of

dairying in sections where this industry is deficient, and the promotion of cattle raising in areas freed from ticks has been pushed during the year and is yielding results of value in food production and agricultural development.

New publications contributed by the bureau and issued during the fiscal year numbered 86, comprising 1,536 printed pages. In addition to these, the bureau furnished material for 84 articles in the Weekly News Letter to Crop Correspondents and contributed 4 articles to the "Agricultural Outlook" series of Farmers' Bulletins. A number of papers were also contributed to outside scientific and technical periodicals. Under the new plan of publication work adopted by the department at the beginning of the fiscal year, the annual reports of the bureau and its series of bulletins and circulars were discontinued. Material of the kinds that formerly went into those series has since been contributed to the new series of Department Bulletins and the Journal of Agricultural Research, as well as to the Farmers' Bulletins.

The bureau made exhibits at the National Conservation Exposition held at Knoxville, Tenn., from September 1 to October 31, 1913, at the National Corn Exposition at Dallas, Tex., February 10 to 24, 1914, and at a number of State fairs. In all these cases the expenses of transportation and installation were borne by the fair associations.

The number of employees in the service of the bureau at the end of the preceding fiscal year (June 30, 1913) was 3,328. During the year there were 524 resignations and terminations, including 11 dismissals for cause. The accessions by appointment, reinstatement, and transfer numbered 768. The force on June 30, 1914, numbered 3,572, of whom 2,378 were engaged in the work of meat inspection.

The following changes in personnel were made, effective July 1, 1914: Dr. A. M. Farrington, assistant chief of the bureau, was made chief of the Miscellaneous Division; Dr. John R. Mohler, chief of the Pathological Division, was made assistant chief of the bureau; Dr. A. R. Ward was appointed chief of the Pathological Division.

A statement of the work as carried on through the various divisions of the bureau's organization follows:

THE ANIMAL HUSBANDRY DIVISION.

The work of the Animal Husbandry Division has continued in charge of George M. Rommel, chief.

ANIMAL NUTRITION.

In the investigations in animal nutrition in cooperation with the Pennsylvania State College the principal experiment carried out during the year has been to determine the influence of the condition of fatness upon the utilization of feed by fattening cattle. The general experience of stockmen is that with the progress of fattening a greater total amount of food is required to produce a given increase in live weight. The object of the investigation is to determine as accurately as possible the cause or causes of this difference, i. e., whether it is due to an increased maintenance requirement, to a diminishing consumption of food, or to an actual difference in the readiness with which food is converted into tissue.

The investigations upon the drying of urine for analysis have been completed and the results prepared for publication.

Preliminary work has been done upon a method by which it is hoped to modify the respiration calorimeter so as to permit a direct determination of the amount of oxygen consumed by the animal used in experimentation.

The results of several comparisons of the heat production of cattle when standing and when lying were presented before the Eighth International Congress of Applied Chemistry, as were also the results obtained upon the combustible gases excreted by cattle. A comparison of the computed and observed heat production of cattle, including all the experiments, 57 in number, up to the end of 1908, has been published in the Journal of the American Chemical Society and also in Bulletin 126 of the Pennsylvania Experiment Station. These results show a very close agreement between the observed heat production and that computed from the material actually oxidized in the body, and furnish a further demonstration that the law of conservation of energy applies in the animal body, and therefore that the newer method of comparing the values of stock feeds upon the basis of their energy values rests upon a sound scientific foundation.

Seventy-six respiration calorimeter experiments completed up to the end of the fiscal year 1912–13 are now being critically studied.

BEEF AND PORK PRODUCTION INVESTIGATIONS.

BEEF PRODUCTION.

The experimental work with beef cattle which has been in progress in Alabama since 1904 was transferred in the spring of 1914 to Mississippi. The work in Alabama has not only demonstrated the practicability of cattle raising and feeding in the extreme South, but has also guided the practice of farmers as to the proper rations to feed in that section. In Mississippi the object is to study the possibility of cattle raising in sections which have been severely damaged by the invasion of the boll weevil and where cattle raising appears to be the only salvation of the farmer. A survey is being made of the State to determine a suitable location for this work. This work is in cooperation with the Mississippi Experiment Station.

Work was begun in the fall of 1913, in cooperation with the North Carolina Experiment Station, to study the methods of wintering stocker cattle and the most profitable methods of finishing cattle in western North Carolina for the market. The best results in wintering stockers last winter were obtained from cattle which had the run of a meadow composed of orchard grass and red top, with some timothy and clover. The results indicate that the use of meadows for wintering cattle in the mountains of western North Carolina deserves further attention.

In cooperation with the Office of Farmers' Cooperative Demonstration Work, of the Bureau of Plant Industry, the entire time of one man has been devoted to the supervision of cattle-feeding demonstrations in the Panhandle section of Texas. The problem has been largely one of the profitable use of the silo. Silage made of milo maize and kafir corn has proved very satisfactory as a roughage for

fattening cattle, and is much more economical than dry fodder or cottonseed hulls.

The type of silo in that section is extremely important. A great deal of difficulty has been experienced with stave silos on account of the winds causing the staves to shrink so rapidly. Pit silos have been found satisfactory if proper hoisting devices are used.

PORK PRODUCTION.

The experimental work in pork production at the experimental farm at Beltsville, Md., was confined to a study of the effects of copperas as an antidote for cottonseed poisoning. Copperas dissolved at the rate of 4 grams daily per 100 pounds of live weight and mixed with the noon feed gave better results than copperas mixed dry at the same rate with the feed. This experiment indicates a certain amount of value in copperas in rations for pigs composed in part of cottonseed meal. A similar experiment is now in progress.

In experiments conducted in Alabama to determine the feeding value of certain forage crops and the cost of raising and fattening hogs in the prairie section, the fact was brought out that the cost of raising pigs to weaning time is usually underestimated in that section. No profit was made from the pigs up to weaning time, if the prevailing prices were used as a basis, but a good profit was made in growing and fattening the hogs after weaning for market.

BOYS' PIG CLUBS.

The pig-club work taken up in 1912 in cooperation with the Louisiana State University has been continued. Similar work was begun in Alabama and Georgia in 1913 in cooperation with the State agricultural colleges. This work has been growing rapidly. During the summer of 1913, 1,500 boys were enrolled in Louisiana and about 500 in Alabama. The Georgia work was not begun until the fall of 1913. The enrollment of pig-club members for the year 1914 closed May 1. At that time there were in Louisiana 2,500 members, in Alabama 1,800, and in Georgia 980.

Ham and bacon clubs were started among the boys and girls in Georgia, and liberal prizes have been offered at the State fair for the exhibits of ham, bacon, lard, etc., by members of the clubs.

Creditable exhibits were made at nearly every county fair in 1913 in which pig clubs were organized.

HOLSTEIN CATTLE BREEDING.

The work of the North Dakota Holstein Breeding Circuit Association in cooperation with the North Dakota Experiment Station, which has been in progress for some years, was transferred to the Dairy Division of this bureau on July 1, 1914. An indication of the work which has been done in the time that this work has been in progress is given by the results in two herds, showing the improvement during the last four years. In one herd, by means of better feed and care of the same cows, the average net profit per cow was increased from $16.38 in 1910 to $47.08 in 1913. In another herd the poor cows were eliminated with the aid of the Babcock test and daily milk records, with an average increase from $9.89 to $36.53 in the same period.

BELTSVILLE FARM.

The experimental farm at Beltsville, Md., has been greatly improved in appearance and equipment during the last fiscal year. A road has been built by using the odd time of laborers and teams, and several buildings have been completed. A great deal of effort has been made to bring up the fertility of the soil, and much improvement is noticed. Plans are now under way to develop the animal husbandry portion of the farm for experimental work, particularly for sheep, hogs, and poultry, and especially to study the questions of the use of forage crops and the problems of maximum range required for best results.

HORSE AND MULE INVESTIGATIONS.

COLORADO WORK.

The breeding experiments in cooperation with the Colorado Experiment Station in the production of horses suitable for carriage and general work is progressing well. The stallions Carmon and Albion, weighing 1,300 and 1,370 pounds, respectively, are available for public service at Fort Collins, and two of the other stallions bred at the station were sent last spring to other parts of the State and one to Wyoming. Recently C. K. G. Billings presented to the Government his famous Standardbred stallion Wilmering (48569). This stallion has been sent to the Colorado stud and should prove of great value in that work.

The following statement shows the animals in the stud on June 30, 1914:

Age.	Stallions.	Mares.	Total.
5-year-olds or over	6	32	38
4-year-olds	.....	2	2
3-year-olds	.....	4	4
2-year-olds	.....	6	6
Yearlings	12	6	18
Weanlings	6	13	19
Total	24	63	87

VERMONT WORK.

The breeding of Morgan horses at the Morgan Horse Farm, at Middlebury, Vt., has been very successful during the past year. Of the 24 mares 4 years old or over, 16 have produced foals, 15 of which are living, and 4 of the other mares are due to foal soon. Nine of the stallions from the farm were sent to other parts of Vermont and New Hampshire for the spring breeding season.

The following statement shows the number of horses on the Morgan Horse Farm on June 30, 1914:

Age.	Stallions.	Mares.	Geldings.	Total.
Aged	9	20	[1] 4	33
4-year-olds	4	4	.....	8
3-year-olds	2	3	1	6
2-year-olds	2	4	.....	6
Yearlings	3	2	.....	5
Weanlings	10	5	.....	15
Total	30	38	5	73

[1] Work horses.

ARMY HORSE BREEDING.

For convenience in administration the Army horse-breeding work has been divided into three districts, the first comprising the States of Vermont and New Hampshire, with headquarters at Middlebury, Vt.; the second, Virginia and West Virginia, with headquarters at Front Royal, Va.; and the third, Kentucky and Tennessee, with headquarters at Lexington, Ky. During the 1914 spring breeding season 9 Morgans were located at various places in the first district; 3 Saddle, 5 Standardbred, and 15 Thoroughbred stallions in the second; and 6 Saddle and 5 Standardbreds in the third.

In the first district 331 mares were bred to the 9 Morgan stallions. During the 1913 breeding season (May to October) 7 of the stallions were located at various points in Vermont and New Hampshire, and 279 mares were bred.

In the second district 1,074 mares were bred to the 23 stallions. During the 1913 breeding season 848 mares were bred to the 22 stallions located in that district.

In the third district 803 mares were bred to the 11 stallions, and during the 1913 breeding season 423 mares were bred.

RAISING HORSE AND MULE COLTS.

In the fall of 1912, 20 weanling horse foals and 20 weanling mule foals were purchased and shipped to the experimental farm at Beltsville, Md. Records are being kept to determine the comparative cost of raising horse and mule foals. The feeding value of corn silage is also being studied.

CERTIFICATION OF PURE BREEDING OF IMPORTED ANIMALS.

Under the provisions of paragraph 492 of the tariff act of August 5, 1909, and paragraph 397 of the tariff act of October 3, 1913, the bureau during the fiscal year has issued certificates of pure breeding for the following numbers of animals imported for breeding purposes: Horses, 2,924; cattle, 859; sheep, 802; hogs, 25; dogs, 594; cats, 21.

The tariff act of October, 1913, placed all cattle, sheep, and hogs on the free list; consequently certificates of pure breeding have not been issued for those classes of animals imported since that time.

POULTRY INVESTIGATIONS.

IMPROVEMENT OF THE FARM EGG OUTPUT.

The propaganda work of the Animal Husbandry Division, growing out of investigations begun in Kansas in 1910 which called attention to the superior keeping quality of the infertile egg, has been continued. A placard showing the contrast between infertile and fertile eggs was issued, and 65,000 copies have been distributed. The Postmaster General gave his permission to have copies of this placard posted in post offices throughout the country. Farmers' Bulletin 528, Hints to Poultry Raisers, contains a reproduction of this placard, and has met with an enormous demand. One firm dealing in produce

paid for 50,000 copies for use among its customers. As an outgrowth of this infertile-egg campaign the Missouri State authorities developed the slogan "Swat the rooster," and shortly afterwards the "rooster day" idea was promulgated. It is believed that the first "rooster day" was held in the State of Tennessee, on May 23, 1914. On that day buyers of poultry agreed to pay the same prices for roosters that they were quoting for hens. This idea was tried in several States and was met with great favor. Roosters by the thousands were sent to market.

COMMUNITY BREEDING OF POULTRY.

In cooperation with the demonstration agent for Frederick County, Va., the Animal Husbandry Division is encouraging the community breeding of poultry in that county. The breeds to be used are the Barred Plymouth Rock, Rhode Island Red, and Single Comb White Leghorn. These breeds are being segregated in different sections of the county and each section encouraged to breed exclusively the variety selected. The farmers are responding readily.

POULTRY INVESTIGATIONS AT BELTSVILLE.

At the Beltsville farm experiments in breeding and in natural and artificial incubation are still in progress. Feeding experiments to determine the most economical rations for the farmer to use are also under way.

POULTRY CLUBS.

The work of this division in the organization of poultry clubs in cooperation with the Office of Farmers' Cooperative Demonstration Work, begun in 1912, has been extended until there are now agents of the division in the States of Kentucky, Tennessee, Virginia, North Carolina, and South Carolina. When originally started these clubs were for girls alone. It has been found impracticable, however, to put into effect the policy of segregation, and it has been necessary to include the boys. The clubs are now known as boys' and girls' poultry clubs. In 1913 there were clubs in two counties in Virginia with 104 members. In 1914, 8 counties of Virginia had clubs, with 511 members. In North Carolina 5 counties have clubs, with 291 members. In Tennessee 5 counties were organized, with 400 members. Kentucky, with 5 counties organized, had 314 active members and 59 honorary members. In South Carolina 3 counties were organized, with 88 active members and 259 honorary members. The total membership of the poultry clubs is 1,922. Honorary members are parents of children or clubs of older people.

OSTRICH INVESTIGATIONS.

The appropriation bill for the fiscal year 1914 included an item for the study of the conditions surrounding the feeding and breeding of ostriches. This work was begun as soon as possible, in cooperation with the Arizona Ostrich Breeders' Association, at Cashion, Ariz., but has not been under way long enough to obtain definite results.

SHEEP AND GOAT INVESTIGATIONS.

The sheep industry is passing through a critical stage, but there are indications that in the future it is to be of a more permanent character and more carefully studied and managed on both farm and range.

RANGE SHEEP BREEDING INVESTIGATIONS.

The experiments begun in 1906 with a view to developing a type of range sheep for the intermountain section has made satisfactory progress. The flock now contains 500 high-grade Rambouillet ewes of breeding age.

NEW ENGLAND SHEEP BREEDING.

The Southdown flock at the Morgan horse farm now numbers 60 breeding ewes. Some trouble has resulted from infection of the lambs with stomach worms. A rotation of forage crops has been adopted which should reduce the extent of this injury. An increased interest in sheep raising in Vermont is shown by the demand for the rams bred at the farm.

CROSSING SOUTHDOWN AND BARBADOS SHEEP.

There are now 30 ewes in the experiment of crossbreeding Southdown and Barbados sheep. Some individuals appear to retain much more than others of the Barbados breeding habits and prolificacy. The records kept make it easy to recognize such individuals.

PRODUCTION OF PERSIAN LAMB FUR.

During the fall of 1913, 20 lambs having three-quarters Karakule and one-quarter Barbados blood were dropped. The skins of eight of these averaged $4.75 in value. There is little doubt that skins of uniformly good quality can be produced in this country. The flock in this experiment now contains 24 half-bred and 23 three-quarter-bred females.

BREEDING MILCH GOATS.

Of the Saanen stock, there are now on hand 10 does 2 years old, 12 yearlings, and 19 kids. There are 10 yearling Toggenburg does and 7 kids. The 10 half-bred 2-year-old Saanen does have been milked since freshening and yield from two to three times as much milk as did their native dams.

CLASSIFICATION OF WOOLS.

Work on the classification of wools was begun in September, 1913. A careful study has been made in the Boston market of the condition in which American wool arrives and of the system of grading. At the mills the sorting of wools was studied, as well as the effects in manufacturing of various defects due to the growers' methods of handling wool. This information has been prepared for publication. An exhibit explaining the various factors that determine the value of wool and showing the loss of value from improper handling has been assembled for use in educational work in the wool-producing States.

SHEEP AND WOOL CONFERENCE.

At the call of the Secretary of Agriculture, a conference was held at the National Museum, Washington, D. C., on June 2, 3, and 4, 1914, to discuss conditions surrounding the sheep and wool industry and to determine, if possible, the proper steps to be taken to bring about more favorable conditions. This conference, while small in numbers, represented every phase of the industry. Farmer breeders, western woolgrowers, dealers, and manufacturers were present. The discussions were friendly, and were confined entirely to the subjects at hand. No resolutions were presented, but the conference appointed a committee to draft a statement addressed to the Secretary of Agriculture, embodying the principal features brought out during the discussion. This statement recommended as measures for the encouragement of the sheep industry a system of national bounties for the destruction of predatory animals, legislation to prevent the killing of sheep by dogs, the fixing of standards for grading wool, the establishment of Government experimental sheep-breeding farms with facilities for instruction, and the publication of the proceedings of the conference.

THE DAIRY DIVISION.

The bureau's work relating to the dairy industry is carried on by the Dairy Division, of which B. H. Rawl is chief.

As part of the varied activities of this division, public meetings of many kinds are attended by its representatives. During the year such meetings numbered 909, and included fairs, exhibitions, conventions, farmers' institutes, schools, short courses in dairy instruction, lectures, and meetings of associations, clubs, etc.

DAIRY FARMING INVESTIGATIONS.

The principal lines of dairy-farming investigations, in charge of Helmer Rabild, consist of southern dairying, community development of dairying, cow-testing association work, and the dairy demonstration farm at Denison, Tex.

Some of the more striking results have been an advance in silo construction, the spread of the cow-testing association movement, improvement in the character of dairy cattle by purchase and as a result of record keeping, and eagerness for creameries in the South. Three hundred and seventy-four silos were built with the aid of the Dairy Division.

SOUTHERN DAIRYING.

The progress of the southern field work in dairy farming has been more encouraging this year than ever before. This is especially true in Mississippi and Louisiana, where devastation by the boll weevil has turned many of the farmers toward the keeping of live stock. The work in North Carolina has been reorganized, broadened, and put on a good substantial basis. Recently there has been a great wave of enthusiasm for creameries in North Carolina, which has created a rather serious problem, since there are so few localities where creameries can at present be made a success. Requests for

assistance in the erection of plants have been received from 25 or 30 localities.

The growth of silo construction in the South has made it impossible to continue on the old plan of furnishing personal assistance to all farmers who desire to build silos. The number of silos built with more or less assistance from the field men in the past year is 347, as against 602 in all the years previous. The work for this reason is being turned over to the county agents to a very large extent.

Some of the best results of the year's work in Mississippi, South Carolina, and North Carolina have been obtained from butter-making demonstrations and similar work in connection with schools.

The great need for short, practical publications on fundamental dairy subjects is being met by the issuance of circular letters on timely subjects at seasonable intervals.

COW-TESTING ASSOCIATIONS.

The cow-testing association movement has continued to spread. Seven States in which there were no such associations before have this year organized associations, viz, Connecticut, New Jersey, West Virginia, South Dakota, Missouri, Louisiana, and North Carolina. A national conference was held at the National Dairy Show, and nine State dairy associations devoted some of their sessions to this subject.

During the fiscal year 81 cow-testing associations were organized, 25 of them with the assistance of Dairy Division field men. On July 1, 1914, there were 163 active associations in existence, with about 4,106 members and 73,280 cows. The average number of herds in associations throughout the country is 26 (exactly the theoretical number), and the average number of cows in each association is 467.

COMMUNITY DEVELOPMENT OF DAIRYING.

The work for community development of dairying at Algona, Iowa, progressed very satisfactorily during the year. The people of the community look with favor on the project, and the press has given much attention to it. There have been many inquiries about the work from creameries in different parts of the country. At least five creamery boards have visited this creamery to observe the methods and plant. Much improvement has been made in dairying methods. During the year a new creamery building was erected, for which plans were prepared by the dairy engineer of the Dairy Division.

DAIRY DEMONSTRATION FARM, DENISON, TEX.

The dairy demonstration farm near Denison, Tex., has had a good year. The crops for the year 1913 were good. The two silos were filled to the roof, and both horse and cow barns were filled with hay. Only about 100 bales of alfalfa had to be purchased.

The herd has done reasonably well; the improvement in appearance is notable. Only 3 of the 35 cows which were on hand five years ago now remain. There are now 36 young cows. Since July 1, 1913, 11 cows and heifers have been sold and 2 have died. Twenty-five heifers and 25 bulls were born. All the heifers are alive and look well.

There have been no ticks on any of the cattle since August, 1912. The hogs made a very good profit, about $850 worth having been sold.

A serious loss was suffered in the destruction of the horse barn by fire, which resulted from lightning, on March 26, 1914. In the barn were the major part of the farm machinery and about 150 bales of cane hay.

EXPERIMENTAL WORK IN DAIRY PRODUCTION.

The experimental work in dairy production, in charge of T. E. Woodward, is carried on mainly at the bureau's experimental farm at Beltsville, Md., which is shared by the Animal Husbandry and Dairy Divisions.

The results of the experiment in feeding prickly pear, made at Brownsville, Tex., have been issued in brief form for the agricultural press, and a full report has also been prepared for publication. A manuscript on the influence of southern cattle ticks on body weights and milk production has also been prepared.

The open-barn experiment, the silage experiments, and the experiment concerning the influence of water in the ration upon composition of milk have been continued at Beltsville. The numerous experiments in feeding sour milk to young calves have resulted satisfactorily, and the results have been given to the agricultural and dairy press. Cornstalk extract prepared by the Bureau of Plant Industry by three different processes has been fed to cows, and no difference has been noticed in the palatability of the three forms. Some potato flour furnished by the Bureau of Chemistry was fed to 35 different animals. It was found to be not so palatable as corn meal, wheat bran, cottonseed meal, linseed meal, and alfalfa meal, but was eaten readily enough to be used as a feed for dairy cows.

FARM OPERATIONS AND LIVE STOCK AT THE BELTSVILLE FARM.

The market value of the crops harvested as feed at the Dairy Division farm at Beltsville, Md., in 1913 was estimated at $3,005.16. The total cost of their production was $2,667.75. The total cost of crops grown to be used for fertilizer and green manure in 1914 was $835.25. Ten purebred animals and 8 grades born on the farm during the year have been retained for breeding purposes. The estimated value of this young stock was $1,985. The value of milk, calves, and other produce leaving the farm amounted to $5,128.10.

A considerable amount of work on building construction and other permanent improvements has been performed. The buildings now completed consist of a main barn, three silos, a milk house, a herdsman's cottage, a tool shed, and a workshop. The office and laboratory building and the west wing of the barn are nearly completed. The east wing of the barn is about half completed. The total cost of these structures at the end of the fiscal year amounted to $31,583.08.

MARKET-MILK INVESTIGATIONS.

The work of the section of market-milk investigations, of which Ernest Kelly is in charge, is largely educational in character, and is carried on mainly in cooperation with city health departments with the object of improving local milk conditions.

CITY INSPECTION.

Fourteen cities in eight States were visited during the year in order to give definite assistance to the work of dairy inspection; 128 dairy farms and a number of city milk plants were scored, and instruction was given to city inspectors concerning the use of a uniform system of dairy inspection. The methods and personnel of city milk inspection seem to be constantly improving. At the present time 245 cities use some form of score card, though not all have adopted the latest changes recommended by the Official Dairy Instructors' Association. About 14,000 copies of various score cards have been distributed by the Dairy Division, of which 9,500 were for inspection of farms.

WORK WITH DAIRY FARMS AND CITY MILK PLANTS.

At the request of milk commissions, scores have been made of 18 certified milk farms.

Members of the section have conducted eight milk contests in seven States. These contests have proved to be of great educational value for the producer, the distributer, and the consumer. Lectures on the economy and sanitation of the milk supply have been given in 19 meetings, and 11 exhibits illustrating dairy sanitation have been sent out.

Systematic surveys of 69 milk plants have been made, in which data on the cost of various operations have been obtained. The results show that the methods of doing business at many plants are not economical.

In March the section began to send monthly circular letters to milk dealers. These letters summarize the results obtained in the survey work, and convey other information that is of value to dealers in regard to methods.

The collection of samples from dairies holding permits to deliver milk in departmental buildings in Washington, D. C., has been continued; 119 milk samples and 18 cream samples were taken, and 36 scores were made at the city milk plants from which these products came. The milk from 6 dairies has been examined, 2 of which have had their permits revoked.

Experiments have been conducted to determine the length of time necessary to cool milk when bottled warm and to determine the weight of a gallon of milk sold in the city of Washington.

WESTERN DAIRY INVESTIGATIONS.

The western dairy investigations, in charge of J. E. Dorman, include work relative to dairy farming, market milk, and dairy manufacturing. The principal part of the work has been done in Utah, Idaho, Oregon, and North Dakota. The object is to assist in the development of dairying in the West, where the reduction in the free range and the advance in the price of land have turned the landowners toward dairying, but with an insufficient knowledge of dairy operations.

One of the most striking results of the work in Utah has been the increase in the use of silage. At the beginning of the fiscal year there

were probably only 5 silos in the State, but during the year 20 concrete silos have been built and at least 15 of them filled. All were found to be satisfactory.

The interest taken in cow-testing associations in Oregon is worthy of mention. Seven new associations have been organized and one reorganized.

The herd-record work in the country schools in Colorado, Oregon, and Utah has been very successful, as indicated by the herd records which are kept by pupils in 14 country schools in Oregon, 15 in Utah, and 12 in Colorado. The number of herds under direct supervision with record keeping is 38.

The specialist on market milk has rendered assistance to milk plants by furnishing plans for buildings, and has been instrumental in forming an association known as the Pacific Northwest Association of Dairy and Milk Inspectors.

The creamery work during the past year has consisted chiefly in aiding in the improvement of the quality of butter and the efficiency of manufacturing.

DAIRY MANUFACTURING INVESTIGATIONS.

The investigations in regard to dairy manufacturing, in charge of S. C. Thompson, consist mainly of studies of processes and products from a commercial standpoint and in the application of this information.

NAVY BUTTER.

During the year 500,000 pounds of sweet-cream butter was put up in 5-pound cans, lacquered on the inside, and 80,000 pounds was packed in tubs for the Navy Department. Samples of the canned butter were held in storage about eight months before scoring; the deterioration was about half a point less than that for 1912. Tub butter showed even less deterioration in storage than the tinned butter. Several lots of butter bought by the Navy Department on quarterly contract have also been inspected, amounting in all to 121,000 pounds, of which 90,000 pounds was passed. Also, 2,000 pounds of cheese was inspected and passed.

CREAMERY OPERATIONS.

Reports were received from 1,205 creameries showing the quantities of milk, cream, and butter fat received, the quantity of butter made, the prices paid the farmers for butter fat, and the prices received for butter, together with the expense of operating the business, and the expense incurred in hauling cream to the creamery. These reports are carefully studied and furnish valuable information, which is used as a basis for advising creamery operators in keeping correct records and improving methods. The output of the creameries reporting aggregated 186,473,200 pounds, which is nearly one-third of the creamery butter made in the United States.

The issuing of circular letters each month to creameries cooperating with the division has been continued.

An investigation of laundry work as a side line to creameries has shown that if well managed it is a source of profit (even greater than

the creamery in one place) and is well appreciated in the community, being used by the farmers much more than was expected.

The work of collecting information regarding new creameries and cheese factories has been continued. Our records show that during the year 152 creameries and 17 cheese factories were built. Many of the factories have requested and received plans of organization, articles of agreement, blue-print plans, and lists of equipment. In this way the cooperation of new creameries is secured from the very start.

Creamery promoters have been working in several States, much to the disadvantage of the industry and at a loss to the people who are induced to build a creamery under their plans. The Dairy Division field men have been actively opposing such efforts where conditions are not favorable.

FARM BUTTER MAKING.

In July, 1913, the States of Tennessee, Kentucky, North Carolina, South Carolina, and Virginia were visited to determine the possibilities of carrying on demonstrations in farm butter making to advantage. It was finally decided to begin this work in the vicinity of Nashville, Tenn. The work has progressed gradually and is favorably considered among the dairymen. The general quality of the butter has been somewhat improved and more uniformity is apparent.

CHEESE FACTORIES.

The cheese-factory reports received indicate no material change in methods of operating or in the results obtained. The total output of 417 factories reporting was 44,781,204 pounds, which was about one-eighth of the total output of all the factories in the country. Blanks were sent to cheese-factory operators to report on disposal of the whey. The results have been compiled and issued in a circular letter sent to cheese makers.

RESEARCH LABORATORIES.

The research laboratories of the Dairy Division, in charge of L. A. Rogers, deal with chemical and bacteriological problems relating to dairy products.

BACTERIOLOGY OF MILK.

Several investigations of the bacteriology of milk have been in progress, and several papers containing results have been published. The study of 150 cultures of *Bacillus coli* from cow feces show that 148 of these were typical *Bacillus coli communis*, and only one of the aerogenes type. The remaining culture was of a type not previously observed. An incompleted study of *B. coli* cultures from grain indicates that this habitat is the source of a hitherto undescribed variety.

Streptococci cultures from infected udders may be divided into two classes by means of biochemical reactions. The work on alkali-forming bacteria has revealed sharp distinctions in the ability of different cultures to utilize certain organic acids. Normal bacteria of the udder, aside from the streptococci, appear to belong to chromogenic micrococci from the surface of the skin.

Work with the alcohol test for determining the purity of milk has shown that this test is dependent on the acidity of the milk, the amount of rennet present, and the presence of large amounts of carbon dioxid or of colostrum milk. Since a large number of bacteria may be present in milk without producing any one of these factors, it would appear as if there were no constant relation between the reaction to the test and the number of bacteria present.

It has been found that many streptococci survive pasteurizing at 145° F., and that this is apparently not a peculiarity of any particular strain, though all the cultures from infected udders were destroyed by this temperature.

Our work has demonstrated that it is practicable to bottle milk hot from the pasteurizer, and cool it in a blast of cold air. This permits efficient pasteurization in ordinary bottles in a small plant without expensive equipment.

BUTTER INVESTIGATIONS.

The butter work has been seriously interrupted by the abandonment of the laboratories at Troy, Pa. It has been found that the rate of oxidation and the consequent change in flavor are correlated with the composition of the butter. The process of heating butter oil to a pasteurizing temperature during the blowing has been tested in the laboratory and in large and small factories. The high temperature of blowing does not in any way impair the flavor, texture, or keeping quality of the butter, and the time is materially reduced.

CHEESE INVESTIGATIONS.

The final results in making cheese from pasteurized milk show that this is possible by means of proper acidification of the milk. Although the cheese is somewhat lacking in typical Cheddar flavor, it is of uniform quality, and the danger of abnormal fermentation is much reduced. A detailed study has been made of the bacteria growing in the cheese during the ripening period, which an improved laboratory technic has demonstrated to be present in large numbers and in considerable variety. The influence of some of these bacteria on the flavor of the cheese has been studied, and although the specific bacteria giving the desired Cheddar flavor have not been determined, sufficient progress had been made at the time the work was terminated to give an assurance that this could be accomplished.

It has been found possible to prepare Cheddar cheese for market by packing in 1-pound cans at the press, but it is difficult to get a maker to put up a uniformly good quality, and dealers often refuse to handle it because the cans swell. Good cheese of the Swiss type is now produced almost at will in our laboratories both by the addition of mixed cultures from old cheese and by the use of pure cultures. It has been ascertained that unripened cheeses, such as cream and Neufchâtel, have so much sugar that they can not be used as food for diabetics, while ripened cheeses of the Cheddar, Swiss, and Limburger types are entirely free from sugar. Although oxalic acid, an active poison, is produced by many molds, it is not produced by the molds prevalent in Limburger and Roquefort cheese. The growth of a typical Roquefort mold is controlled by the supply of oxygen available in the interior of the curd.

The work on Camembert cheese has furnished all the information necessary to enable manufacturers to make a product equal to the imported.

OTHER INVESTIGATIONS.

The investigations on casein have demonstrated that the essential difference between buttermilk casein, which could not be used for paper coating, and skim-milk casein, which answered every purpose, was due to the presence of fat, salts, and other impurities in the former. When these were removed by proper washing, the casein obtained from buttermilk equaled the best made from skim milk. A simple method has been devised for the thorough washing of buttermilk curd, formerly a difficult process.

It has been found possible to make a condensed skim milk suitable for ice-cream manufacture by the blowing process. Experiments in ice-cream making have been transferred from the dairy manufacturing section to the research laboratories. It has been found that fat improves the flavor when added in proportions up to about 15 per cent, while gelatin in all proportions is detrimental to both natural and artificial flavors.

It has also been demonstrated that the flavor of garlic may be entirely removed from milk by blowing air through it while it is held at a temperature of at least 140° F. An exposure of 30 minutes at 145° F. is sufficient to free the milk from the most objectionable flavor. Similar results were obtained with cream, but a longer exposure was necessary.

The section has cooperated with the experimental farm at Beltsville in experiments with preserving silage and other experiments. Several papers reporting research work have been prepared for publication.

NAVAL ACADEMY DAIRY.

Cooperation with the United States Naval Academy at Annapolis, Md., in the management of the dairy at that institution has been continued. The plant was scored seven times. The bacterial counts ranged from 900 to 7,800 bacteria per cubic centimeter, which is exceedingly low. This dairy compares very favorably in both score and bacterial count with the best certified milk dairies, and there has been a material reduction in sickness among the midshipmen since the plant was installed.

DAIRY ARCHITECTURE AND ENGINEERING.

The work in architecture has included the preparation of plans for stock dairy buildings, special buildings, dairy equipment, experimental apparatus, illustrations for bulletins and surveys, and plans and specifications, as well as superintendence of construction work at the Beltsville experiment farm and the Naval Academy dairy farm. Plans for several laboratories have also been prepared and the construction work superintended.

The practical construction work at the Beltsville farm was the erection of a building to contain the offices, laboratories, and milk-handling equipment. The building was 80 per cent completed on June 30.

The investigations in dairy engineering have included studies on refrigeration, the forced-draft method of cooling milk, pasteurizing

milk by the forced hot-air draft, and various studies in the mechanical equipment of milk plants, creameries, and dairies.

Plans and specifications have been prepared for a refrigerating plant at the experimental farm at Beltsville, Md., and for a refrigerating and ice-making plant at the Naval Academy dairy farm, Gambrills, Md. Assistance has been rendered in the modifications which have been made in the cold-storage rooms of the Dairy Division laboratories. Specifications for machinery for an experimental creamery and milk-condensing plant are in preparation; also plans and specifications for the electrification of the Annapolis dairy farm.

Blue prints of 1,079 sets of plans were distributed during the year. These included plans for barns, silos, milk houses, creameries, manure sheds, ice houses, etc.

THE MEAT INSPECTION DIVISION.

The Federal meat inspection is carried on by the Meat Inspection Division, of which Dr. R. P. Steddom is chief.

INSPECTION OF DOMESTIC MEATS.

The work for the year shows a slight increase in the number of ante-mortem and post-mortem inspections, but a slight decrease in the quantity of meat food products prepared and in export shipments. The number of cattle and calves slaughtered under Government inspection shows a decrease of over 700,000 from the preceding fiscal year, and a decrease of 3.5 per cent as compared with the average of the previous seven years, the period during which the present law has been in force; while the swine show an increase over 1913 of more than a million and an increase of 2.6 per cent over the average for the previous seven years.

Inspection was conducted at 893 establishments in 244 cities and towns, as compared with 910 establishments in 251 cities and towns during the fiscal year 1913.

Inspection was begun at 101 establishments and withdrawn from 74 establishments, as compared with 63 and 115, respectively, during the fiscal year 1913. The causes of withdrawal were as follows: Discontinuance of slaughtering or of interstate business, 62 establishments; failure to comply with the requirements of the department, 10; granting of market inspection, 1; and 1 establishment consolidated with another.

Statistics of the meat inspection for the year are given in the tables that follow:

Ante-mortem inspections of animals, fiscal year 1914.

Kind of animals.	Passed.	Suspected.[1]	Total inspected.
Cattle	6,696,124	53,454	6,749,578
Calves	1,810,416	2,762	1,813,178
Swine	33,260,583	113,573	33,374,156
Sheep	14,969,589	4,555	14,974,144
Goats	122,316	29	122,345
Total	56,859,028	174,373	57,033,401

[1] This term is used to designate animals found or suspected of being unfit for food on ante-mortem inspection, most of which are afterwards slaughtered under special supervision, the final disposal being determined on post-mortem inspection.

Post-mortem inspections, fiscal year 1914.

Kind of animals.	Passed for food.	Passed for lard and tallow only.	Condemned.	Total.
Cattle	6,669,700	6,061	48,356	6,724,117
Calves	1,808,171	37	6,696	1,814,904
Swine	32,936,784	147,979	204,942	33,289,705
Sheep	14,937,432	839	20,563	14,958,834
Goats	121,051	30	746	121,827
Total	56,473,138	154,946	281,303	56,909,387

Diseases and conditions for which condemnations were made on post-mortem inspection, fiscal year 1914.

Causes of condemnation.	Cattle.		Calves.		Swine.		Sheep.		Goats.	
	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.
Actinomycosis	430	85,068	9	666						
Adenitis					4		1			
Adhesions							2			
Arteriosclerosis	1									
Asphyxiation	5		8		1,448		120		1	
Atrophy	1	2			5	5		2		
Autointoxication	5				3		2			
Blackleg	9		10							
Bone diseases	9	1	1	1	82	1				
Caseous lymphadenitis							4,695	29	91	
Cellulitis				1	21	612				
Cerebral apoplexy					8					
Contamination	4	2,071	3	4	94		7	18		6
Cyanosis						2,932	5			
Cysticercus	615	2,011	35	5	93		364			
Dropsical diseases	28		1		52	98	28	832		
Emaciation	6,697		1,295		914		6,425		527	
Exhaustion	1				2		6			
Frozen			2		12					
Gangrene	169	4	23		37		28		3	
Hernia	6		1		58		6			
Hog cholera					116,107					
Hydronephrosis			1		7		1			
Hyperemia	9	9	1		16		16			
Icterus	55		35		3,075		1,898		40	
Immaturity			2,297		12		2			
Injuries, bruises, etc	3,151	619	542	69	1,197	6,561	934	224	13	1
Leukemia	316		5		147		13			
Melanosis	23	5	11	1	96		12			
Moribund	56		9		74		51		4	
Necrobacillosis	6				1		134	391		
Necrosis	3	293			7		7			
Parasitic diseases	4				156		15			
Phlebitis			396							
Pneumonia, pleurisy, enteritis, peritonitis, metritis, etc	4,502	7	626	2	17,011	89	4,463	13	40	
Pregnancy and recent parturition	133				90		155		10	
Septicemia, pyemia, uremia	1,699		253		11,738		1,041		10	
Sexual odor					1,866				5	
Skin diseases				2	78	15	9			
Texas fever	358		703							
Tuberculosis	29,738	44,975	407	308	48,252	407,151	4	1		
Tumors and abscesses	323	3,020	22	175	2,179	4,809	119	54	2	1
Total	48,356	138,085	6,696	1,234	204,942	422,275	20,563	1,564	746	8

In addition to the foregoing, there were tanked the carcasses of animals found dead or in a dying condition as follows: Cattle, 1,297; calves, 1,063; swine, 58,499; sheep, 5,654; goats, 188; total, 66,701.

The inspection of meat and meat food products prepared and processed under the supervision of bureau employees is shown in the following table. This is a statement of work done and not a report of the actual quantity of products prepared. The same product is sometimes duplicated by being reported in the various stages of preparation and under more than one heading.

Meat and meat food products prepared and processed under bureau supervision, fiscal year 1914, in pounds.

Kind of product.	Weight.	Kind of product.	Weight.
Beef placed in cure	156,718,568	Lard stearin	5,571,570
Pork placed in cure	2,568,334,605	Lard compound	7,730,284
All other classes placed in cure	3,497,071	Lard substitute	581,616,296
Sausage chopped	542,016,832	Bakers' compound	1,062,345
Canned beef	90,887,435	Oleo stock and edible tallow	55,835,685
Canned pork	24,889,756	Oleo oil	146,791,463
All other canned meats	4,695,852	Oleo stearin	71,997,502
Meat extract	294,130	Oleomargarin	143,999,030
Steam and kettle rendered lard	1,110,393,385	Miscellaneous products	1,432,583,307
Leaf lard	20,528,075		
Neutral lard	57,041,508	Total weight	7,033,295,975
Lard oil	6,811,276		

The quantity of meats and meat food products condemned on reinspection because of having become sour, tainted, putrid, unclean, rancid, or otherwise unwholesome was as follows: Beef, 7,357,692 pounds; pork, 11,475,262 pounds; mutton, 258,168 pounds; veal, 42,096 pounds; goat meat, 2,251 pounds; total, 19,135,469 pounds.

Market inspection was extended to one more city, making 42 cities at whose public markets Federal meat inspection is conducted in order that interstate deliveries may be made in accordance with the meat-inspection law and regulations.

For the export of meat and meat food products 90,197 certificates of inspection were issued, covering 136,007,894 pounds of beef, 764,092,656 pounds of pork, and 4,156,331 pounds of mutton, a total of 904,256,881 pounds. This included 229,038,475 pounds specially prepared with preservatives as allowed by foreign Governments.

There were also issued 2,259 certificates for exports of 18,432,526 pounds of inedible animal products.

EXEMPTION FROM INSPECTION.

The provisions of the meat-inspection law requiring inspection do not apply to animals slaughtered by farmers on the farm nor to retail butchers and dealers. The department requires that such butchers and dealers, in order to ship meat and meat food products in interstate commerce, shall first obtain certificates of exemption, but no such requirement is made of farmers. The number of certificates of exemption outstanding at the close of the fiscal year was 1,927, a decrease of 621 from the previous year. During the year 737 certificates were canceled on account of the dealers retiring from business or ceasing to make interstate shipments, 303 were canceled for violations of the regulations, 22 on account of regular inspection being granted, and 101 for miscellaneous reasons, making a total of 1,163 cancellations. In a number of cases the certificates were reissued when business was resumed or the insanitary conditions had been corrected.

During the fiscal year 114,976 shipments were made by retail butchers and dealers holding certificates of exemption, as compared with 124,384 shipments in 1913. The products so shipped were as follows:

Shipments by retail butchers and dealers under certificates of exemption from inspection, fiscal year 1914.

Product.	Number.	Pounds.	Product.	Number.	Pounds.
Beef, carcasses (1,942 quarters)	485	240,828	Cured meats		1,142,542
Calves, carcasses	47,353	4,118,691	Lard		133,406
Sheep, carcasses	4,949	172,467	Sausage		217,555
Swine, carcasses	2,120	210,533	Miscellaneous (scrapple, tripe, headcheese, etc.)		125,761
Beef, fresh		5,532,215			
Veal, fresh		452,784			
Mutton, fresh		1,352,705	Total	54,907	14,207,884
Pork, fresh		508,397			

During the fiscal year 87,155 interstate shipments were made of meats and meat food products from animals slaughtered by farmers on the farm. The products so shipped were as follows:

Shipments of farm-slaughtered products under exemption, fiscal year 1914.

Product.	Number.	Pounds.	Product.	Number.	Pounds.
Beef, carcasses (2,467 quarters)	617	269,131	Cured meats		684,290
Calves, carcasses	144,877	11,398,978	Lard		191,449
Sheep, carcasses	15,378	463,505	Sausage		136,047
Swine, carcasses	20,853	2,053,429	Miscellaneous (scrapple, tripe, headcheese, etc.)		28,578
Beef, fresh		113,247			
Veal, fresh		73,162			
Mutton, fresh		17,568	Total	181,725	15,828,579
Pork, fresh		399,195			

INSPECTION OF IMPORTED MEATS.

Under the provisions of the tariff act of October 3, 1913, inspections of imported meats and meat food products were made by the bureau as shown in the following table:

Imported meat and meat food products inspected, fiscal year 1914.

Country of origin.	Fresh and refrigerated meats.		Cured and canned meats.	Other products.	Total weight.
	Beef.	Other classes.			
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	99,435,955	5,239,512	902,273	2,118,017	107,695,757
Australia	20,778,321	5,883,926	5,765,704	91,114	32,519,065
Canada	13,135,702	5,124,775	4,275,745	248,418	22,784,640
Uruguay	28,032,771	1,653,270	269,897	4,512	29,960,450
Other countries	956,796	936,455	744,637	1,791,548	4,429,436
Total	162,339,545	18,837,938	11,958,256	4,253,609	197,389,348

Rejections or condemnations amounted to 0.28 per cent of the quantity inspected and were as follows: Beef, 440,777 pounds; veal, 2,803 pounds; mutton, 10,561 pounds; pork, 97,718 pounds; total, 551,859 pounds.

INSPECTIONS FOR THE ARMY AND THE NAVY.

At the request of the War and Navy Departments, inspections were made of meat and meat food products offered for the use of the Army and the Navy to determine whether they conformed to the specifications. The meats and products inspected for the Army amounted to 93,035 pounds, of which 32 pounds was rejected. For the Navy 15,565,952 pounds was inspected, of which 510,210 pounds was rejected. There were also inspected for the Navy 92,145 dozen eggs, 15,235 dozen of which were rejected.

THE FIELD INSPECTION DIVISION.

The Field Inspection Division, of which Dr. R. A. Ramsay is chief, conducts administrative work for the control and eradication of contagious diseases of live stock.

ERADICATION OF SOUTHERN CATTLE TICKS.

As the result of the work done in cooperation with authorities of various Southern States for the extermination of the ticks which spread the infection of splenetic fever in cattle, areas aggregating 28,704 square miles, as shown by the following table, were released from quarantine. The total area released from the beginning of this work in 1906 up to June 30, 1914, amounts to 215,908 square miles, being a territory greater than the combined areas of Mississippi, Alabama, Georgia, and Florida. The work is also far advanced in a large additional territory.

Areas released from splenetic-fever quarantine as a result of eradicating cattle ticks, fiscal year 1914.

State.	Square miles.	State.	Square miles.
Alabama	625	Oklahoma	3,716
Arkansas	1,708	South Carolina	530
Georgia	1,103	Tennessee	2,617
Louisiana	650	Texas	6,515
Mississippi	7,910	Virginia	726
Missouri	49		
North Carolina	2,555	Total	28,704

In addition to the States named in the table, operations are being carried on in California and Florida.

The total number of inspections made during the year was 7,276,240, as against 6,277,295 in the preceding year.

In addition to the large number of inspections made and dippings supervised, a great deal of educational and demonstration work was conducted by bureau employees.

Approximately 21 miles of fence was constructed near the Mexican boundary line to prevent the infection of territory in Arizona from the ranging or straying of tick-infested live stock into this country from Mexico. The construction of approximately 55 miles of fence for this purpose near the southern boundary of California was also completed.

INTERSTATE TRANSPORTATION OF LIVE STOCK.

The number of cattle shipped from the area quarantined for splenetic or southern fever to market centers outside of the quarantined area was 963,560, as compared with 1,320,559 during the fiscal year 1913. This was a decrease of 27 per cent in the number of tick-infested cattle shipped from the quarantined area for immediate slaughter. There were reshipped from the quarantine pens at market centers to points where southern cattle are permitted to be shipped for immediate slaughter 325,736 head, being a decrease of 18.5 per cent from the preceding year.

The number of cattle of the quarantined area dipped and certified for movement as noninfectious was 165,204, being a decrease of 36 per cent from the fiscal year 1913. Of this number, 56,808 were second dippings. During the fiscal year 1,374 certificates were issued for the shipment to northern markets of free cattle and those dipped or otherwise treated as provided for in the regulations.

There were inspected at market centers for scabies and other contagious diseases 13,695,026 cattle, of which 104,794 were dipped under bureau supervision in order that they might continue in interstate transit. Sheep to the number of 31,685,757 were inspected at stockyard centers for scabies and other contagious diseases, and 1,788,475 were dipped under bureau supervision, in order that they might be disposed of for purposes other than immediate slaughter.

There were cleaned and disinfected under bureau supervision 32,158 cars which had contained animals affected with contagious diseases.

ERADICATION OF SHEEP SCABIES.

The following areas were released from quarantine on account of scabies in sheep, as a result of the work of eradication carried on in cooperation with State officials: Arizona, 21,552 square miles; Colorado, 2,100 square miles; Nevada, 41,663 square miles; New Mexico, 122,503 square miles; Utah, 45,994 square miles; total, 238,812 square miles. The States of Arizona, Kentucky, and New Mexico have been entirely freed from quarantine.

The number of inspections of sheep by bureau employees engaged in the eradication of scabies in sheep in the area quarantined for that disease was 20,639,428. The number of sheep dipped for scabies in that area was 7,517,578. These inspections and dippings were in addition to those mentioned under the heading "Interstate transportation of live stock."

ERADICATION OF CATTLE SCABIES.

The following areas were released from the quarantine for scabies in cattle: New Mexico, 40,382 square miles; South Dakota, 11,476 square miles; Nebraska, 716 square miles; Montana, 55,258 square miles; Texas, 30,714 square miles; Oklahoma, 6,760 square miles; Wyoming, 5,353 square miles; total, 150,659 square miles.

The number of inspections of cattle during the year by bureau employees engaged in the eradication of scabies in cattle in the area quarantined for that disease was 2,812,632. The number of cattle dipped for scabies in that area was 1,807,950. These figures are in addition to those given under the heading "Interstate transportation of live stock."

The increase in the number of cattle dipped for scabies, notwithstanding a decrease in inspections, is due to cooperation by the bureau with the State of Texas in enforcing a general dipping order on over a million cattle in the quarantined area in the fall of 1913.

SCABIES IN HORSES.

The number of horses and mules inspected for scabies during the year was 2,132. No dippings were performed.

GLANDERS IN HORSES.

During the year 1,610 inspections of horses and mules were made at Indian schools and agencies, and 1,594 animals were found to be free from glanders, 15 reacted to the mallein test, and 1 showed suspicious symptoms. This work was done in cooperation with the Office of Indian Affairs of the Department of the Interior.

LIP AND LEG ULCERATION OF SHEEP.

Inspections for lip and leg ulceration (necrobacillosis) in sheep were made at market centers in connection with inspections for other infectious and contagious diseases of animals, and 7,530 sheep were found to be infected and 7,118 to have been exposed to this disease and were disposed of in accordance with the regulations.

INSPECTION AND TUBERCULIN TESTING OF CATTLE FOR INTERSTATE MOVEMENT.

There were inspected by bureau veterinarians, in compliance with the laws of the States to which the animals were destined and upon request of transportation companies or cattle owners, 142,904 cattle moving interstate for purposes other than immediate slaughter, of which number 25,389 were tested with tuberculin. Of the number tested 1,007 were found to be diseased with tuberculosis and 114 showed temperatures which required them to be held as suspects for further examination.

INSPECTION AND MALLEIN TESTING OF HORSES AND MULES FOR INTERSTATE MOVEMENT.

There were inspected by bureau veterinarians, in compliance with the laws of the States to which the animals were destined and upon request of transportation companies or shippers, 49,748 horses and mules, 10,016 of which were tested with mallein, 31 showing typical reactions to the test and 5 showing such increase in temperature that they were held for further examination.

VIOLATIONS OF LIVE-STOCK TRANSPORTATION AND QUARANTINE LAWS.

During the year 1,608 reports of alleged violations of the 28-hour law, involving 1,545 cases reported for prosecution, were submitted by employees of the bureau and placed before the Solicitor of the department. Many cases required special investigations, which necessitated considerable travel and expense. Six bureau employees are regularly assigned to this work. However, the greater part of the work of collecting evidence and preparing and submitting reports is done by bureau employees at stockyard centers in connection with their other duties.

There were submitted to the Solicitor 230 reports (involving 254 cases reported for prosecution) of alleged violations of the quarantine laws and the regulations based thereon, as follows: Splenetic or southern fever, 188; sheep scabies, 8; cattle scabies, 23; glanders, 2; tuberculosis, 6; hog cholera, 1; other contagious diseases, 2.

THE QUARANTINE DIVISION.

The Quarantine Division, under the direction of Dr. R. W. Hickman, chief, has had a year of unusual activity, due to increased importation of purebred live stock from across seas for breeding purposes; the disturbed conditions along the Mexican border, necessitating very careful inspection to prevent the introduction of tick-infested cattle into tick-free areas of the United States; the increased importation of live stock for grazing and slaughter, resulting from the removal of the tariff on food-producing animals; and the work of eradicating dourine from some of the Northwestern States.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS AND PRODUCTS.

During the first half of the fiscal year there were more purebred cattle imported from Great Britain and the Channel Islands than during the entire preceding year. On November 12, however, an outbreak of foot-and-mouth disease was reported from Sussex, England, in consequence of which the department suspended the issuance of permits for ruminants and swine from the United Kingdom until March 28, when a shipment of 652 cattle from the Channel Islands was permitted to come forward under rigid precautions and certain special conditions prescribed by the department. On June 20 shipments were resumed from Great Britain.

The following tables show the number of animals imported during the fiscal year:

Imported animals inspected and quarantined, fiscal year 1914.

Port of entry.	Cattle.	Sheep.	Swine.	Goats.	Other animals.
New York	1,983	85	3	15	276
Boston	72	651	16	.....	.....
Baltimore	11	6	1	4	129
Canadian border ports	3,550	23	123	4	2
Total	5,616	765	143	23	407

Imported animals inspected but not quarantined, fiscal year 1914.

Port of entry.	Cattle.	Sheep.	Swine.	Horses.	Goats.	Other animals.
New York	.....	.....	.....	3,047	.....	7
Boston	.....	.....	.....	141	3	8
Philadelphia	.....	.....	.....	14	.....	120
Baltimore	.....	.....	.....	66	.....	.....
Portland, Me	4	.....	.....	12	.....	.....
San Francisco	.....	6	.....	5	.....	293
New Orleans	.....	.....	.....	54	1	7
Mexican border ports	640,233	198,635	1,906	32,330	257,129	20
Canadian border ports	208,765	15,358	13,284	6,759	12	227
Total	849,002	213,999	15,190	42,428	257,145	682

TUBERCULIN TESTING OF CATTLE IN GREAT BRITAIN.

During the year the bureau has maintained two veterinary inspectors in Great Britain, whose services have been available for the tuberculin testing before shipment of cattle purchased by prospective importers. The results of the tests made are shown in the following table:

Results of tuberculin tests in the United Kingdom of cattle for importation into the United States, fiscal year 1914.

Breed.	Passed.	Failed.
Aberdeen Angus	15	1
Ayrshire	39	6
Dexter	4	
Guernsey	1,287	14
Jersey	433	5
Shorthorn	111	23
Total	1,889	49

In addition to the foregoing, the following cattle, not having been tuberculin tested before shipment, were tested in quarantine: Alderney, 55; Guernsey, 4; Jersey, 10; Aberdeen Angus, 4; Shorthorn, 1; all of which passed the test.

SPECIAL PRECAUTIONS AND INVESTIGATIONS.

In the fall of 1913 a disease appeared in an importation of cattle from England at the bureau's animal quarantine station at Athenia, N. J., which caused alarm owing to its similarity to foot-and-mouth disease of Europe. After a careful clinical examination of all the affected animals by the chief of the Pathological Division a diagnosis of mycotic stomatitis was made.

Owing to the great danger of introducing into this country diseases which might menace the live-stock industry, the regulations governing the inspection and quarantine of imported live stock have been strengthened, and it has been found advisable among other things to exclude all visitors from quarantine stations, including owners of imported stock, except when acting as attendants, throughout the quarantine period.

In November the bureau received through the Department of State a report from the American consul at Tampico, Mexico, of a disease affecting the feet and mouths of cattle in his consular district. Because of the large number of cattle being imported from Mexico at that time it was deemed advisable to detail an inspector to investigate and determine the exact nature of the disease and to supervise shipments of cattle from that port. It was found that the affection was not foot-and-mouth disease, but mycotic stomatitis.

Notwithstanding the disturbed conditions in northern Mexico, importations of all classes of animals, except swine, from that section to the United States have shown an increase for the past year.

QUARANTINE OF IMPORTED HORSE STOCK.

An amended regulation governing the importation of horses and asses which went into effect in December, 1912, has been in force

during the past year. One provision of this regulation is that horses may be quarantined at the port of entry at the expense of the owner and subjected to blood or other tests as may be required to determine their freedom from disease.

IMPORTATION OF HIDES, FEEDSTUFFS, ETC.

A close supervision over importations of hides, horns, bones, glue stock, horsehair, plucked and picked wool, feedstuffs, straw, etc., has been continued, with the object of preventing the introduction of the infection of anthrax or other diseases with such products.

INSPECTION OF VESSELS AND EXPORT ANIMALS.

The work in connection with the inspection of vessels and export animals has been continued throughout the year, 245 inspections of vessels carrying live stock having been made before clearance, and 226 certificates of inspection having been issued for American cattle, sheep, swine, and horses for shipment to foreign countries.

There has been a small number of export shipments of purebred animals for breeding purposes, and in order to encourage such trade and insure shipment of breeding cattle free from tuberculosis, B. A. I. Order 139 was amended on May 26, 1914, in such manner as to provide for the tuberculin testing by an inspector of the bureau of all dairy and breeding cattle carried by ocean steamers to foreign countries.

The following table gives statistics of inspections of live stock for export:

Inspections of American and Canadian animals for export, fiscal year 1914.

Kind of animals.	American.			Canadian.	
	Inspections.	Tagged.	Exported.	Inspections.	Exported.
Cattle	1,000	34	1,000	5,836	5,836
Sheep	9,617	.....	9,617	.....	.....
Swine	246	.....	246	.....	.....
Horses	1,162	.....	1,162	.....	.....
Mules	486	.....	486	.....	.....
Goats	20	.....	20	.....	.....
Buffaloes	5	.....	5	.....	.....
Dogs	7	.....	7	.....	.....
Total	12,543	34	12,543	5,836	5,836

During the fiscal year 11,249 horses and 716 mules were tested with mallein for shipment to Canada. Of this number 136 horses were rejected on account of reacting to the test.

For Canadian shipment 638 cattle were also tested with tuberculin, of which 12 reacted; and inspections were made of 50,664 sheep, 120 swine, and 493 goats.

For shipment to the Hawaiian Islands, 110 cattle were tested with tuberculin, of which 5 reacted; the mallein test was applied to 81 horses and 298 mules, of which 3 horses reacted; and inspections were made of 8 swine.

COOPERATIVE TUBERCULOSIS INVESTIGATIONS.

Cooperative tuberculosis investigations have been continued with satisfactory results. Such cooperation has been conducted with owners of cattle herds in different States, the dairy and food division of Virginia, the Commissioners of the District of Columbia, the health department of the District of Columbia, the Michigan State Live-Stock Sanitary Commission, and various medical milk commissions. Among the latter were those of Cincinnati, Louisville, and Chicago.

A special effort has been made to interest and assist the owners of purebred herds of cattle to maintain their exhibition and sale herds free from tuberculosis.

The tuberculin testing of cattle and sanitary inspections at United States Indian schools have been continued wherever inspectors have been available for assignment to such work.

Under the direct supervision of the Quarantine Division, tuberculin tests were applied during the year to herds of cattle which included 18,883 animals.

The following statement shows the results of the activities in the District of Columbia, Virginia, and Maryland:

Results of tuberculin testing of dairy cattle in Maryland, Virginia, and the District of Columbia, fiscal year 1914.

State or District.	Total.	Passed.	Reacted.	Percentage of reactors.
Virginia:				
Original tests	2,483	2,201	282	10.14
Annual retests	5,779	5,577	202	3.49
Total	8,262	7,778	484	5.87
Maryland:				
Original tests	1,195	1,061	134	11.21
Annual retests	1,155	1,113	42	3.64
Total	2,350	2,174	176	7.49
District of Columbia	1,628	1,589	33	2.03
Total	12,240	11,541	693	5.66

ERADICATION OF DOURINE.

Cooperative work begun in the latter part of the fiscal year 1913 for the eradication of dourine of horse stock in Montana, North Dakota, and South Dakota was continued throughout the year, and was extended to an area in northeastern Wyoming. A special appropriation of $100,000, which became available for dourine eradication on February 23, enabled the bureau to place a large force of inspectors in the field during the last four months of the year. It has been possible in the work of inspection and blood testing to cover in a fairly satisfactory manner the infected area of western North Dakota and South Dakota and eastern Montana and Wyoming. The presence of dourine is determined by the Pathological Division of the bureau by means of the complement-fixation test. The number of animals tested and the number of reactors are indicated in

the report of that division. Animals reacting to the complement-fixation test have been placed in quarantine and appraised and slaughtered as rapidly as possible under the supervision of State and bureau veterinarians. In indemnifying owners there has been adherence, so far as practicable, to State laws governing appraisal and destruction of diseased horse stock. One-half the appraised valuation of animals destroyed has been paid from bureau funds, such share, however, not exceeding $100 for any one animal. There has been general and hearty cooperation on the part of horsemen in connection with efforts to eradicate this disease.

THE PATHOLOGICAL DIVISION.

The work of the Pathological Division, under the direction of Dr. John R. Mohler, chief, has comprised the scientific investigation of a number of infectious animal diseases.

DOURINE.

The work which necessitated the greatest deviation from the customary investigations of the laboratory was the diagnosis of dourine from samples of blood serum drawn from exposed and suspected horses in several of the Northwestern States. As many as 1,200 samples a day have been tested, and a total of 51,293 were examined during the fiscal year, of which 2,550 gave positive reactions to the complement-fixation test for dourine.

This outbreak offered a splendid opportunity for a further study of the disease. Accordingly a carload of 18 horses in which the disease had been diagnosed by the complement-fixation test were purchased and shipped to the experiment station at Bethesda, Md. The horses selected for this work were mostly latent cases, and only three showed clinical manifestations on arrival at Bethesda. The blood of these horses had been subjected to complement fixation in order to determine the smallest amount of serum of each horse which would give a fixation.

The horses were divided into four groups, three of which were to be subjected to treatment with chemico-therapeutic agents, while the fourth group was to be used in infection experiments for the transfusion of their blood into healthy animals. For the treatment of the three groups, neosalvarsan, trixidin, and atoxyl were used. The treatment extended from January 22 to April 3. The injections were made at regular intervals, atoxyl every four days, and the neosalvarsan and trixidin at intervals of eight days. All the injections were made intravenously and the doses increased almost to the height of tolerance. The blood of the treated animals was subjected to periodical tests in order to determine the effect of the treatment. The testing of the blood was also continued after the administration of the last treatment. The results of the test appeared the same at the end of the period as prior to the treatment, and in no case was there a marked change in the complement fixation noticeable.

HOG-CHOLERA INVESTIGATIONS.

It has frequently been suggested that isolated outbreaks of hog cholera, occurring without other well-established cause, might be

due to the presence in the food given to the hogs of bits of rind and trimmings from bacon originating with hogs that had been affected with hog cholera. In order that a conclusive test might be made, eight sides of pork were obtained from hogs that were affected with hog cholera in varying degrees, ranging from slight to very severe cases. These sides were subjected to the processes usually employed in curing bacon for market. Both brine-pickling and dry-salting methods were used. After the bacon was fully cured the rind and subcutaneous fat were removed, sliced, and fed to healthy pigs, each side of bacon being fed to two pigs. None of the experimental animals developed hog cholera as a result of this feeding. For purposes of control and in order to determine if any natural immunity existed, the pigs used in this experiment were inoculated with virulent blood from a case of hog cholera four weeks after they had been fed the prepared bacon. Two additional animals were used as checks. All of the experimental and check animals developed typical symptoms of hog cholera, and six died from that disease.

Another experiment somewhat related was carried out with kidneys which contained petechiæ, frequently resembling kidneys found in hogs affected with hog cholera, but obtained from hogs that showed no other signs of being affected with that disease than the hemorrhages would indicate. The conclusion was reached that the presence of hemorrhagic kidneys only was not sufficient evidence to warrant a diagnosis of hog cholera.

Microscopic studies were made of hemorrhagic kidneys from cases of hog cholera and those from cases of glomerular nephritis, and certain changes were found by which the two conditions may be readily distinguished.

CEREBROSPINAL MENINGITIS OR FORAGE POISONING.

Cerebrospinal meningitis or forage poisoning has been enzootic in Texas, Montana, Illinois, Kentucky, Virginia, Maryland, and Delaware, and has continued to be the subject of investigation.

As cerebrospinal meningitis of horses often appears in animals fed on a rather changeless diet, it was thought advisable to subject experiment animals to such a diet to see if this would produce symptoms simulating the disease in question. This experiment was undertaken because in human medicine a group of diseases of obscure causation, i. e., pellagra, beriberi, and scurvy, are thought to be due to the lack of some essential element of nutrition in the diet. In the case of beriberi this element is contained in the outer portion of rice grains that is milled off before the rice is marketed. Horses subjected to an almost exclusive diet of polished rice (milled rice) and of hominy (i. e., corn without the outer shell) for a long time, however, showed no inconvenience or symptoms of nervous derangement.

Animals which had died of forage poisoning were examined bacteriologically and gave growths of diplococci, streptococci, and pyocyaneus organisms, all of which have been encountered in previous work on this disease; but until a causal relationship can be proved they must be still held as germs of agonal invasion rather than germs of pathogenic importance.

INFECTIOUS ABORTION OF CATTLE.

During the fiscal year 727 samples of serum from cattle were tested by the application of the serum tests for this disease. Nothing new has been developed in this respect. It is still impossible from the tests to define the status of an animal with regard to abortion other than to state that where a positive reaction is obtained that animal is or has been infected with *Bacillus abortus* of Bang, and to establish the presence or absence of the infectious form of abortion upon a particular farm.

The propylactic treatment by means of bacterins has been put to further trial in six good-sized herds, and from reports of these it is hoped to obtain sufficient data to estimate the value of this mode of treatment. Prevention of abortion by means of isolation and the installation of a system of hygiene has been recommended to most correspondents on this subject.

Wide circulation has been given through the agricultural press to an article claiming that methylene blue afforded protection to cows from contagious abortion. The experiment was therefore made of feeding methylene blue to cows known to be eliminating the organism of abortion with their milk. Although fed in such quantities that the milk secreted by the cows was tinged with blue, it failed to destroy the abortion bacilli in the udders of the cows.

Large doses of hexamethylenetetramin and urotropin were fed to four cows for the purpose of ascertaining whether this substance would pass into the udder as formaldehyde and exert a disinfecting action on the *Bacillus abortus* known to be present in the udders. The hexamethylenetetramin passed into the milk, but none of it was decomposed into formaldehyde.

IMMATURE AND HAIRLESS PIGS.

From several of the Western and Middle States reports of the farrowing of hairless and immature pigs have been received.

In March, 1914, a fully developed hairless pig was received from Middlebury, Ind., with a history that it was two weeks premature, and that other sows on the same farm had also aborted. No further information from this source was obtained, although requested. Cultures made from the liver, stomach contents, and kidneys revealed an organism resembling *Bacillus abortus* in cultural and morphological characteristics. These cultures when used as antigens in both agglutination and complement-fixation tests gave the same results with two known negative, two known positive, and with unknown bovine sera, as were obtained with our antigens prepared from *B. abortus* of Bang from bovine origin.

From three different farms in the State of Montana samples of serum from six sows that had farrowed hairless pigs were received. These samples were tested with the agglutination test, using the strains obtained from the Indiana outbreak and *B. abortus* of bovine origin as antigens, but in none of these cases did we obtain high agglutination value. Three of these samples showed partial agglutination in 0.02 c. c. and complete in 0.04 c. c., while the other sera were negative even in 0.04 c. c. The same sera showed no distinct agglutination when the organisms causing abortion in mares were used as antigens. Material for further work has been requested.

WHITE SCOURS IN CALVES.

Several severe outbreaks of white scours occurred among calves in herds that were available for investigation. The *Bacillus aerogenes* was isolated in pure cultures. A healthy cow was then inoculated with suspensions of the organism, and serum obtained from its blood was injected into pregnant cows in infected stables some six weeks before the termination of their pregnancy as a prophylactic measure for the protection of their calves. The calves were injected shortly after birth with a bacterin prepared from *B. aerogenes* as a further prophylactic measure, and the injection was repeated after an interval of 10 days. No decisive results have yet been obtained.

SWAMP FEVER.

Experiments in the diagnosis of swamp fever have been continued, but no satisfactory method has been discovered by which a laboratory diagnosis can be made from material from a suspected case. Inoculation of susceptible horses with suspected material furnishes the best test at present available, but this is necessarily impracticable as a routine procedure and is resorted to only in experimental work. It has been quite well established that the disease is not spread directly by mere close association in a stable. It is therefore very probable that infection takes place indirectly through an intermediate carrier, such as insects or intestinal parasites, though no particular carrier has as yet been definitely incriminated. No treatment, either preventive or curative, has yet been discovered.

CHRONIC BACTERIAL DYSENTERY.

Further opportunity was offered to study chronic bacterial dysentery (Johne's disease) through the receipt of specimens of intestines from cattle suspected of having died of this disease. Material forwarded from Virginia, Texas, Oregon, and the District of Columbia revealed the characteristic lesions and the causative microorganism of this affection as a result of laboratory examination. Cultures of this bacterium have been obtained, and experiments are now being conducted to discover a diagnostic method which will locate the affected animals in a herd before they develop physical symptoms of the disease.

RABIES.

Examination of the brains of animals for rabies has been continued. There were submitted for examination 183 specimens, consisting of tissues from 161 dogs, 11 cows, 3 horses, 3 mules, 4 cats, and 1 hog, and of these there were found to be affected 110 dogs, 8 cows, 1 horse, 2 mules, and 3 cats.

ANTHRAX.

Fifteen samples of blood were received from animals suspected of having died of anthrax. Laboratory investigations demonstrated the presence of living organisms of anthrax in three of the specimens.

DIAGNOSIS OF GLANDERS.

The complement-fixation test for the detection of glanders in suspected cases has been applied to 2,052 samples of serum, of which 414 gave positive results.

THE OPHTHALMIC TEST FOR GLANDERS.

In view of the favorable results obtained from the ophthalmic test for glanders in other countries, the bureau for more than a year has carried out extensive investigations with a concentrated mallein. For this purpose the cooperation of official and practicing veterinarians in various parts of the country was solicited. Ophthalmic mallein was furnished to all practitioners who desired to make a careful study of the method and establish its comparative value with other tests for glanders, especially the subcutaneous mallein test. In this experimental work about 18,000 horses have been subjected to the ophthalmic test, and in most cases it has been applied simultaneously with the subcutaneous mallein test. Veterinarians who employed the method appear to be unanimous in their preference of the eye test.

The comparative diagnostic tests for glanders which have been carried out by the bureau in connection with immunization experiments in glanders, and in several outbreaks of the disease, have proved the eye test to be reliable and practicable. As a result of these favorable findings the bureau recognized this method of diagnosis for the interstate shipment of equines.

BLACKLEG VACCINE.

The Pathological Division prepared for free distribution 2,373,540 doses of blackleg vaccine, which is an increase of 24 per cent over the preceding year.

DISEASES OF BIRDS.

A large number of carcasses of birds, both wild and domestic, were received for diagnosis. The diseases observed covered a wide range and offered considerable material for research. Apparently there was a decline in the mortality among incubator chicks from such diseases as white diarrhea and brooder pneumonia.

TOXIC FLY LARVÆ.

Recently the attention of the bureau was directed by Dr. E. W. Saunders, of St. Louis, Mo., to the marked toxicity of the larvæ of the green bottle fly (*Lucilia cæsar*). He had found that larvæ grown on fowls dead of so-called limberneck, when fed to guinea pigs, rabbits, fowls, and monkeys, would cause death. The importance of the subject lies in the fact that fowls have frequent opportunity to feed on green-fly larvæ when carcasses of chickens or other animals allowed to remain unburied become fly-blown. Considerable work has been done in the main laboratory of the Pathological Division for the purpose of determining the exact nature of the causative agent. The investigation has not progressed sufficiently to reach any definite conclusions.

THE ABDERHALDEN PREGNANCY TEST.

Repeated attempts were made to acquire the technic of the Abderhalden pregnancy test for the purpose of using this test in the early diagnosis of pregnancy in cattle and with a view to adapting it to the diagnosis of disease. Thus far the results have been only partially satisfactory.

COMPARISON OF THE SEDIMENT TEST WITH THE BACTERIAL COUNT OF MILK.

For the purpose of comparing the sediment test with the bacterial count of milk, samples were collected from milk cans as they arrived on the station platform at Philadelphia from various farms in the adjacent country. Upon arrival at the laboratory the temperature was taken and a bacterial count made. After preparing plates each sample was passed through one of the Gerber sediment disks, an apparatus for determining the amount of dirt in milk. The disks were kept and compared with the bacterial count. A similar comparison was also made with the Wizzard and Lorenz apparatus.

After 50 samples had been tested with each apparatus 20 samples were filtered through four plies of cheesecloth, 20 through one thickness of absorbent cotton, and 20 through one thickness of canton flannel. Each of these samples was then subjected to the sediment test and a bacterial count was also made in each case. This was done to determine the effect of straining the milk before applying the sediment test. A comparison was also made of the filtered samples with the bacterial count after passing through the cotton disks used in the Lorenz apparatus, with the following results:

1. The Lorenz apparatus was found to be most convenient and practicable for demonstrating dirt in milk.
2. The quantity of sediment present on the disk is no criterion as to the kind or number of bacteria in the milk.
3. The various sediment tests are applicable only in roughly estimating the amount of sediment in unstrained milk, and can not be used solely as a means of determining the hygienic condition under which the milk was produced.
4. If milk is previously strained through the substances mentioned, the sediment testers are of little value in estimating the amount of visible dirt.

CONTROL OF VIRUSES, SERUMS, TOXINS, ETC.

Under authority of an act of Congress effective July 1, 1913, the control of the manufacture of viruses, serums, toxins, and analogous products used in the treatment of domestic animals was placed under the Bureau of Animal Industry, and a portion of the work was assigned to the Pathological Division. The work was started at the beginning of the fiscal year, but was somewhat delayed by the necessity of inspecting each laboratory in which it was proposed to manufacture biological products for interstate traffic. However, a very uniform willingness to meet all requirements has been shown. Many changes in equipment have been suggested and made, and as a result the products now placed upon the market show marked improvement over those distributed in previous years.

TOXICITY OF DISINFECTANTS.

In conjunction with the Insecticide and Fungicide Board numerous coal-tar and wood-tar products were tested to ascertain the relative toxicity of these disinfectants on animals and to determine whether any of them were "safe," nonpoisonous, and noncaustic, as claimed by the manufacturers.

BRANCH PATHOLOGICAL LABORATORIES.

The work at the branch laboratories at Chicago and South Omaha has consisted mainly of the usual routine packing-house examinations and diagnoses. The work in some respects has been more extensive than in previous years.

From the South Omaha laboratory comes the report that cases of actinomycosis have been far in excess this year over the record for the preceding year. Many cases of neoformation of doubtful character have proved on microscopic examination to be actinomycosis.

Several cases of tuberculosis in sheep were referred to the Chicago laboratory. Sheep have hitherto been practically free from tuberculosis.

An improved method of mounting pathological specimens under watch glasses for museum purposes has been devised at the Chicago laboratory.

THE BIOCHEMIC DIVISION.

The work of the Biochemic Division is under the direction of Dr. M. Dorset, chief.

LABORATORY MEAT INSPECTION.

The laboratory examination of samples of meat and meat food products and of ingredients used in such products has been continued in connection with the meat inspection. The seven laboratories examined a total of 31,839 samples, an increase of 4,575 over the number analyzed during the preceding fiscal year. It indicates an increase in work of approximately 16 per cent without any additional employees. The samples examined were, as usual, of a very varied character.

The results of the examinations show that there is no attempt on the part of establishments where inspection is maintained to use forbidden preservatives. Preservatives have been found at times in products prepared by establishments exempted from inspection, but this practice appears to be less common than in previous years. A considerable proportion of imported meats and meat food products were found to contain forbidden preservatives or to be mislabeled. There continues to be some difficulty in connection with the use of cereal in sausage and prepared meats. As in previous years, it appears that the cases where cereals have been used without proper declaration on the labels are due to carelessness or misinformation on the part of packing-house employees.

The laboratories prepared during the year 4,830 gallons of ink for branding inspected meats. The total cost of this ink, including labor, materials, and containers, was approximately $1,883 for the entire year.

RESEARCH WORK ON MEAT PRODUCTS.

The investigation of the effect of cold storage on meat has proceeded uninterruptedly, but has not continued far enough to warrant any definite report.

An investigation of the effect of storage on canned meats has been continued. This work is to extend over a period of years, with comparisons of the meats after different lengths of time.

A series of investigations concerning the color of uncooked and cooked salted meats was undertaken and completed during the year, and the results have been prepared for publication.

A study of methods of analysis has been continued with the object of increasing efficiency, and some cooperative work with the Association of Official Agricultural Chemists has been carried on, particularly with reference to the methods of analysis of fats and oils and the determination of starches.

Not infrequently inspectors send soft or mushy hams for examination and judgment. The fibers are very soft and easily crushed between the fingers. These hams may or may not have a sour odor. Two such hams were found during the present year to show a heavy infection with *Sarcocystis miescheriana*. Additional hams are now being examined to determine whether the softening of the muscle fibers is due to the presence of this parasite or to other causes.

DIPS AND DISINFECTANTS.

A continuation of the study of the phenomenon of oxidation in arsenical dipping baths has shown that under ordinary conditions the sodium arsenate present in such baths undergoes progressive oxidation. In the course of a few weeks the oxidized arsenic may amount to a notable proportion of the whole per cent. On the other hand, in the case of vats through which exceptionally large numbers of cattle were passed at frequent intervals only slight tendencies toward oxidation were noted. Experience indicated that under ordinary conditions oxidation is not likely to progress far enough to render baths dangerous to cattle when the standard strength of arsenious oxid is maintained.

An outfit for the field assay of lime-sulphur baths has been devised by R. M. Chapin and given practical test in the field. It has proved satisfactory and has been adopted for official use.

There were supplied to field inspectors 147 new outfits, together with the necessary supplies, for use in the field assay of arsenical dipping baths. There were also sent to field inspectors 23 outfits for use in the field assay of lime-sulphur dipping solutions.

An extended investigation of methods for disinfecting hides has been carried on, consisting chiefly of a study of the Seymour-Jones method and the Schattenfroh method. The results of this work have been prepared for publication. The results show that under certain conditions hides contaminated with anthrax spores may be disinfected by means of the Schattenfroh method, while the Seymour-Jones method was apparently less effective.

The examination of samples for the Insecticide and Fungicide Board has been continued. During the year 225 cases under the insecticide act were assigned to the laboratories for examination and investigation, and reports on 126 of these have been made to the board. Dr. James A. Emery represents this bureau on the Insecticide and Fungicide Board.

TUBERCULIN AND MALLEIN.

During the fiscal year 488,446 doses of tuberculin were sent out to State, county, and city officials to be used in testing cattle for

tuberculosis. This was an increase of 28 per cent over the quantity for the preceding year.

Mallein was likewise furnished for testing horses and mules for glanders. From the beginning of the fiscal year until March 1, 1914, 116,642 doses of mallein for the subcutaneous test were furnished. On March 1, 1914, the distribution of that kind of mallein was discontinued and the distribution of a specially prepared mallein for the ophthalmic test was begun. From that date to the close of the fiscal year 102,710 doses of the latter kind were sent out, making a total of 219,352 doses for the year, an increase of over 45 per cent.

HOG CHOLERA.

FIELD WORK.

The act making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1914, contained the following provisions:

> General expenses, Bureau of Animal Industry: * * * For inspection and quarantine work * * * $654.000: *Provided*, That of this sum not less than $75,000 shall be set aside for demonstrating the best method of preventing and eradicating hog cholera.

Prior to the 1st of July, 1913, the department had undertaken no regular field experiments for the eradication of hog cholera. Therefore it was necessary, subsequent to that date, when the appropriation became available, to organize a force of trained inspectors for field work, and to increase largely the very limited facilities for serum preparation.

The plan adopted was to select certain areas in several of the important hog-raising States and to undertake to control hog cholera in these areas with the cooperation of the proper State authorities. The work was located at Ames, Iowa, where the necessary antihog-cholera serum was produced, and in the following counties, which were regarded as suitable for the purpose: Dallas County, Iowa; Montgomery County, Ind.; Pettis County, Mo.; and Johnson and Gage Counties, Nebr.

Work was actually begun in Dallas County, Iowa, on July 1, 1913; in Montgomery County, Ind., on July 15, 1913; in Pettis County, Mo., about August 1, 1913; and in Johnson and Gage Counties, Nebr., about November 1, 1913.

The field work may be grouped under three heads:

1. *Education and organization of the farmers and survey of the experimental area.*—The department has depended largely upon the State college in each case to carry on this work, though considerable assistance has been rendered by inspectors in the Bureau of Animal Industry.

2. *The enforcement of necessary sanitary and quarantine regulations.*—This portion of the work in each State has been assigned to either the State live-stock sanitary board or the State veterinarian, depending upon conditions in the different States. Here again inspectors of the bureau have assisted State authorities.

3. *Application of the antihog-cholera serum.*—In so far as possible the bureau has supplied from its plant at Ames, Iowa, the serum needed in the work, and all serum used in experiments has been administered by inspectors of the bureau.

The organization of the work was as follows:

1. On behalf of the United States Department of Agriculture:

(*a*) *Administrative.*—The general administration of all of the work has been under the direction of the Chief of the Bureau of Animal Industry.

(*b*) *Field force.*—In each county there has been placed one veterinary inspector in charge, two assistant veterinary inspectors, and a clerk. When necessary an additional inspector's assistant has been assigned also to field work.

(*c*) *Laboratory force* (stationed at Ames, Iowa).—One inspector in charge, with three assistant inspectors, a clerk, and laborers. This force is engaged in the production of antihog-cholera serum.

2. Nondepartmental organization:

(*a*) *State officials.*—One man, and in many cases two men, have been assigned by State colleges to spend a limited amount of time in the experimental area for the purpose of organizing farmers, making a survey of the conditions of hog raising, and carrying on a general educational campaign.

(*b*) *Volunteer assistants.*—This force has consisted of intelligent farmers throughout the counties under experiment who have volunteered their services to assist in gathering information.

As the appropriation was not available until July 1, 1913, the assembling of inspectors and their assistants and the expansion of the serum plant at Ames, including the enlargement of pens for hogs and the purchase and installation of additional equipment, were necessarily delayed until after that time. Hog cholera is most prevalent in the summer and fall months. The late start, therefore, resulted in the disease being widespread in all of the experimental areas when the work was begun, thus placing the inspectors at a great disadvantage. Notwithstanding these difficulties, very gratifying results have been secured.

Results accomplished in the summer and fall of 1913 are shown in the following tables:

Report on treatment of hogs in infected herds.

Group A.	Hogs.	Died.	Group B.	Hogs.	Died.
Approximately 70 per cent sick when treated:			Well when treated, but kept in herds with sick hogs:		
Pettis County, Mo	5,904	1,038	Pettis County, Mo	0	0
Montgomery County, Ind	4,562	894	Montgomery County, Ind	4,961	119
Dallas County, Iowa	5,686	1,998	Dallas County, Iowa	6,815	224
Total	16,152	3,930	Total	11,776	343
Per cent loss		24.3	Per cent loss		2.9

Report on treatment of hogs in healthy herds exposed to hog cholera.

	Hogs.	Died.
Pettis County, Mo	5,802	12
Montgomery County, Ind	4,527	53
Dallas County, Iowa	3,149	16
Total	13,578	81
Per cent loss		0.5+

Losses in three counties in 1911, 1912, and 1913.

Period.	Dallas County, Iowa.			Pettis County, Mo.			Montgomery County, Ind.		
	Hogs raised.	Hogs lost.	Per cent of loss.	Hogs raised.	Hogs lost.	Per cent of loss.	Hogs raised.	Hogs lost.	Per cent of loss.
1911	77,274	11,337	12.7	62,590	13,740	18.0	73,920	20 414	21.6
1912	84,618	19,821	18.9	59,661	20,550	25.6	74,554	23,083	24.3
1913	118,550	9,182	7.1	59,792	10,376	14.7	75,974	5,098	6.2
Before July 1, 1913		5,289			9,035				
After July 1, 1913		3,893			1,341				

The first and second tables show the total number of hogs treated, together with the results of treatment. The first table deals with herds which were affected when first visited by inspectors. The hogs in these herds have been divided into two groups. Group A consisted largely of hogs which were sick at the time of treatment, inspectors' reports showing approximately 70 per cent sick when treated. Notwithstanding this fact, only 24.3 per cent of these animals were lost, whereas without the use of the serum it is probable that more than 75 per cent would have succumbed. Group B represents well hogs, although they were in herds with sick hogs at the time of treatment. Among these only 2.9 per cent were lost, whereas a loss of more than 75 per cent was to have been expected without the serum treatment.

The second table gives the results of the treatment of hogs on farms adjacent to outbreaks of hog cholera. These hogs were all exposed to the disease and under normal conditions without preventive treatment a large percentage would no doubt have died. As a result of the treatment the loss was practically negligible, being only slightly in excess of one-half of 1 per cent.

The first and second tables therefore show quite clearly the effectiveness of the serum treatment, especially as a preventive agent.

The third table is based upon statistics secured by a farm-to-farm survey of the three counties under experiment. The figures given are not absolute. It will be noted that in each county the loss in 1913 was materially less than that which occurred in either 1911 or 1912. By referring to the figures given for Dallas County, Iowa, and Pettis County, Mo., it will be noted that by far the greater proportion of hogs which died in these counties in 1913 were lost before the work was begun. Under similar conditions the losses should have been much greater during the last six months of the year than they were during the first six months. The marked diminution in the losses after the department's work was instituted is most encouraging.

The foregoing statement covers the work from the beginning of the fiscal year up to February 23, 1914, when the act appropriating $500,000 for the purpose of the investigation, treatment, and eradication of hog cholera was approved by the President. Of this sum $50,000 was set aside for carrying on examinations and inspections authorized by the act approved March 4, 1913, regarding viruses, serums, toxins, and analogous products for use in the treatment of

domestic animals. The work of the bureau in enforcing the last-named act is discussed elsewhere in this report.

At the time that this new fund was made available the plan which had previously been followed was modified to some extent. The field work since that time has been divided into two projects:

1. *Experiment to demonstrate the practicability of eradicating hog cholera from selected sections of the country.*—This project has been essentially a continuation and extension of the work begun July 1, 1913, and described above. In addition to continuing the work already begun, similar work has been commenced in the following areas: Renville County, Minn.; Branch County, Mich.; Maury County, Tenn.; Allen County, Ohio; Marshall County, Kans.; the irrigated district in the neighborhood of Twin Falls, Idaho; Henderson County, Ky.; Clay County, Iowa; and Kankakee County, Ill. The preliminary organization and survey of these additional counties has in many cases been completed and the work of preventing and controlling the disease in these counties is actively under way. It is planned to extend this work to four additional areas which have not been definitely selected. It is impossible as yet to make any statement concerning the results attained in these new areas.

2. *Demonstrational and educational work among farmers in cooperation with the States in order to bring about a better understanding of the disease and approved methods of combating it.*—This new project is being conducted along lines similar to those developed by the Bureau of Plant Industry in its farm demonstration and county advisory work. It includes the organization of clubs for educational demonstration; cooperation with the Animal Husbandry Division, the Farmers' Cooperative Demonstration Work, and the Office of Farm Management in their fields; the utilization of county advisers and farm demonstrators in educational and propaganda work in methods of preventing hog cholera through sanitary and quantine measures and the use of serum. The fundamental idea is to demonstrate to farmers how they may, by their own efforts, reduce losses from hog cholera.

Under this project the department regards each State as a unit, and recognizes some State authority as the agency through which the cooperative work will be handled. This State representative is usually the president or dean of the agricultural college within the State. This plan is in conformity with the principle laid down in the Lever bill, which has met with widespread approval.

There has been some delay in starting work under the second project, because of the necessity of explaining the nature of the cooperation to State authorities and of securing their agreement to the work, and, secondly, on account of the difficulty in securing men capable of acting as State leaders. This second difficulty has been solved by securing from other branches of the Bureau of Animal Industry highly trained veterinarians for educational work. All of these men have been given a special course of training concerning hog cholera. Up to July 1, seven veterinarians had been selected and assigned to as many different States.

This work has not been in progress long enough to warrant any statement as to results. There seems no doubt, however, that by carrying definite information to the farmers we shall lay the foundation upon which final control and eradication of hog cholera must rest.

RESEARCH WORK.

The making of arrangements for the extensive field work has made it necessary to limit to a large extent the hog-cholera research work which was contemplated. However, a certain amount of investigational work has been carried out, with the following results:

1. It is well known from researches on diphtheria antitoxin and other antisera that the antibodies are associated with, if, indeed, they do not constitute a part of, the globulins of the sera. A limited number of experiments with antihog-cholera serum have shown that the protective principle is present in the globulins of the serum. It appears that at least a large part of these antibodies are separated with the pseudo-globulins, though some experiments have shown that the eu-globulins contain a certain amount of the protective substances. The experiments have not proceeded far enough to determine whether or not this is due to a failure to separate completely the pseudo-globulins from the eu-globulins or whether the protective substance is also actually a part of the eu-globulins.

2. Recently it has been announced by King that there exists in the blood and intestines of animals suffering from hog cholera an organism which he has named *Spirochæta suis*. King and Hoffman, from the results of their studies, claim that this organism is more clearly established as the specific cause of hog cholera than any other known organism. Studies made in the Biochemic Division have shown that spirochætes may be found in considerable numbers in the intestinal contents, and particularly in and around intestinal ulcers, in cases of hog cholera. In no case have these spirochætes been observed in the blood of hogs suffering from hog cholera. An extended examination of the intestinal contents of healthy hogs has shown that the same spirochætes are present there in considerable numbers. Research work of the division has led to the belief that the spirochæte referred to by King is a saprophytic inhabitant of the hog's intestine and that it is in no way responsible for the production of hog cholera, but may enter the blood as a secondary invader.

FEDERAL CONTROL OF VETERINARY BIOLOGICAL PRODUCTS.

Regulations enforcing the provisions of the act governing the preparation, sale, shipment, and importation of viruses and analogous products intended for use in the treatment of domestic animals were promulgated by the Secretary of Agriculture to take effect coincidently with the law, July 1, 1913. The work of the Biochemic Division has related largely to the enforcement of the act with relation to hog-cholera virus and antihog-cholera serum, although the division has also been charged with the supervision of establishments preparing and shipping tuberculin and mallein.

Licenses issued under this law are for the calendar year only. From July 1 to December 31, 1913, there were issued 31 licenses for the calendar year 1913. During the same period there were issued 3 permits to import veterinary biological products into the United States. From January 1 to June 30, 1914, there were issued 61 licenses and 3 permits. During the last-named period two hearings were held, as provided by the law, and the license of one establishment was suspended. Seven alleged violations of the law were reported to the Solicitor, who reported 2 of the cases to the Department of Justice for prosecution, while the remaining 5 were pending

in the Solicitor's office at the close of the fiscal year. Inspectors of the bureau made 426 inspections of establishments for which licenses were desired.

There has been a most noticeable and gratifying improvement in the construction and methods of establishments producing antihog-cholera serum.

THE ZOOLOGICAL DIVISION.

The work of this division is in charge of Dr. B. H. Ransom, chief.

TRICHINOSIS, MEASLES, ETC.

The Zoological Division has carried on investigations regarding parasites encountered in meat inspection. It has been commonly supposed that cold has little or no effect on the vitality of trichinæ, but investigation has shown that when trichinous meat is exposed to low temperatures (0° to 10° F.) the parasites commonly succumb in a few days. In some cases, however, some of the parasites may survive for two weeks or more.

Investigations relative to the thermal death point of trichinæ and the cooking of pork and products containing pork have been continued. The importance of this work is shown by the fact that several outbreaks of trichinosis in Pennsylvania, Wisconsin, and South Dakota were investigated by inspectors from the Meat Inspection Division, and in each instance were traced to sausage or a similar product eaten raw or insufficiently cooked.

Experiments in the refrigeration of beef with reference to the destruction of the vitality of tapeworm cysts were carried out. It was found after beef carcasses infested with measles had been exposed to a temperature of 12° to 15° F. for six days that all the cysticerci were dead. The results of these experiments have been taken as a basis for the recent modification in the meat-inspection regulations permitting beef carcasses slightly infested with measles to be passed for food after refrigeration for 6 days at a temperature not exceeding 15° F., as an alternative to the requirement of 21 days' refrigeration.

Hydatid disease, which is so prevalent in certain South American countries that the sanitary authorities have posted placards warning the public against its dangers, has been found affecting a high percentage of several lots of hogs slaughtered at Richmond, Va. Previously the disease has been found especially frequent among hogs originating from Arkansas and eastern Oklahoma. This disease is caused by the larva of a tapeworm whose adult stage occurs in the dog, other animals and human beings acquiring the parasite as a result of swallowing the eggs of the tapeworm in food or water contaminated by the feces of infested dogs. Dogs acquire the parasite as a result of eating the infested viscera of hogs, sheep, or other animals. The apparent prevalence of the hydatid parasite has led to strict rules in the new meat-inspection regulations as to the admission of dogs to meat-packing establishments.

TAPEWORMS OF SHEEP.

A third year's experiments on the fringed tapeworm in Colorado were completed. Experiments indicate that prophylaxis consists essentially in keeping sheep off of infested range. Lambs were run

with infested mothers under various conditions offering opportunity for infestation from contact, feed, and water, without contracting an infestation. The life history of the worm was not ascertained, but certain groups of animals previously considered as likely intermediate hosts were shown experimentally to play no part in the life history, so far as could be determined.

CATTLE TICK DIPS AND FLY REPELLENTS.

Further investigations on arsenical dips have shown that oxidized dips are less efficacious on cattle ticks than unoxidized dips containing the same amount of arsenic, and from experiments data have been collected toward establishing the relative efficacy on ticks and the relative toxicity to cattle of the oxidized and unoxidized dips.

Comparative tests of various substances and mixtures used for protecting live stock from flies have been made. Some were found to be dangerous, others quite inefficacious, and none continued to repel flies effectively longer than a day or two after application.

MISCELLANEOUS INVESTIGATIONS RELATIVE TO ANIMAL PARASITES.

During the fiscal year 262 imported sheep dogs were examined for parasites, and 121 were found to be infested, 36 of them with tapeworms. The latter dogs were treated with tæniafuges and were not released from quarantine until found free from tapeworms on examination following the treatment. These precautions are taken to avoid the introduction of tapeworms injurious to live stock.

Studies have been made of roundworms parasitic in hogs, including intestinal worms, lungworms, and kidney worms.

A survey of the States west of the Mississippi River and east of the Rocky Mountains shows that the nodular worm, originally and normally a parasite of eastern sheep, is progressing steadily westward and is now some distance west of the Mississippi; whereas the fringed tapeworm, a parasite of western sheep, appears to depend in part on conditions connected with the range sheep industry and is losing ground with the restriction of the range sheep business. The same survey shows more accurately than before the area of fluke infestation, especially for *Fasciola magna*.

In the report for the fiscal year 1911 it was noted that encysted larval nematodes having certain morphological resemblances to the adult gullet worm of sheep and cattle occur in various species of dung beetles, and that in beetle larvæ free embryos had been found resembling the unhatched embryos of the gullet worm. The logical presumption that dung beetles act as the intermediate hosts of *Gongylonema scutatum* has more recently been experimentally verified. It has been shown that the beetles may become infested in the adult as well as in the larval stage.

The Zoological Division cooperated with the Dairy Division in an investigation relative to the influence of tick infestation upon milk production.

Arrangements have been made for an extensive study of methods of controlling or eradicating the internal parasites of sheep, particularly the stomach worm, on a farm near Washington which has been rented for use in this investigation.

INDEX CATALOGUE AND COLLECTION OF PARASITES.

The maintenance of the card catalogue of parasites and parasitic diseases has been continued, and the division has continued to cooperate with the Hygienic Laboratory of the United States Public Health Service in the preparation of certain portions of this catalogue for publication. The bureau collection of parasites is one of the largest and most comprehensive collections of the kind in existence.

THE EXPERIMENT STATION.

The work of the Experiment Station at Bethesda, Md., under the direction of Dr. E. C. Schroeder, superintendent, for the past year was similar in character to that of previous years. As the work done for and in cooperation with other divisions has already received attention, this part of the report will be confined almost entirely to the independent work of the station.

TUBERCULOSIS INVESTIGATIONS.

A number of studies of tuberculosis which have been in progress for several years were continued and several new investigations begun. Some studies on the propagation of the disease indicate that the greatest demonstrable danger is actual contact between tuberculous and healthy animals, and that such contact, even when of short duration, is often seriously effective. On the other hand, no wide separation between tuberculous and healthy animals seems necessary to prevent the spread of the disease from the former to the latter. In the disinfection of barns and stables that have been occupied by tuberculous animals the value of thorough cleaning, reaching all corners and crevices, together with the free use of lime in the form of whitewash and otherwise, has been demonstrated.

Additional studies on the occurrence of tubercle bacilli in the circulating blood of tuberculous animals, with special reference to possible differences in different species, prove that tubercle bacilli are present occasionally in the circulating blood of cattle, hogs, and rabbits shortly before their tuberculous condition terminates in death. However, no species has been found which harbors tubercle bacilli in its blood during a sufficiently early stage of tuberculosis to give the matter the least importance as a factor that requires consideration in meat-inspection regulations.

Further investigations, which are not complete, regarding the relative danger for hogs from their exposure to the milk of tuberculous cows, to the feces of tuberculous cows, and to tuberculous hogs indicate that the feces of tuberculous cows are by all odds the most pernicious. The exposure of healthy to tuberculous hogs does not seem to be sufficiently dangerous to cause the long-continued perpetuation of tuberculosis among hogs.

Various studies relative to the treatment of tuberculosis have been made, but no results have been obtained that hold out much encouragement.

Investigations concerning the possible significance of rats as agents for the dissemination of tubercle bacilli, while not complete, have given some interesting results. It has been found that rats, after they have ingested tuberculous material, continue to expel tubercle bacilli from their bodies with their feces as long as nine days; that rats which have been fed a single day on tuberculous material,

though they show no lesions of tuberculosis, harbor the bacilli in their bodies, particularly in their lungs, in a virulent state, for long periods of time, and that rats injected subcutaneously with minute doses of tubercle bacilli remain chronic carriers of the bacilli for months.

Various samples of commercial tuberculin were tested in the course of the year to determine their efficiency as agents for the diagnosis of tuberculosis among cattle.

INFECTIOUS ABORTION OF CATTLE.

Much attention has been given to the subject of infectious abortion of cattle, a disease which has gained such prevalence and causes so much loss that it must be ranked in importance with hog cholera and tuberculosis. Additional evidence has been obtained to prove that a large proportion of cows that become affected with the disease remain, after seeming recovery, chronic carriers of its specific bacillus.

An attempt has been made to distinguish between milk infected with and that which is free from the abortion bacillus by the use of the so-called agglutination test. It has been found that the agglutinating power of infected milk for the abortion bacillus is a positive factor; that it varies enormously; that it is approximately half as strong as that of blood serum; that it is not at all affected by the souring of milk or the period of time in which milk naturally sours under ordinary conditions; that milk serum, obtained by filtering milk in which the casein has been coagulated by the addition of pepsin, agglutinates as strongly as whole milk; that the agglutinating power of milk is not greatly affected by the degree of temperature commonly recommended for pasteurization, and that it is destroyed by a boiling temperature.

Additional observations have been made on the persistence of the abortion bacillus, after injection, in the bodies of other species of animals than cattle, and on the possible danger that other species may serve as agents for its dissemination.

Experiments regarding the treatment of infectious abortion, though they include some methods defined by their originators as nearly infallible, have not given promising results.

FEEDING EXPERIMENTS WITH RAW, PASTEURIZED, AND STERILIZED MILK.

Extensive experiments have been made to determine the relative value as food of raw, pasteurized, and boiled milk. The animals used in this work were unweaned guinea pigs. Boiled milk gave better results than raw or pasteurized; and even sterilized milk, kept 30 days or longer before it was fed, caused no abnormal conditions comparable to those often attributed to the use, under artificial conditions, of the heated milk of one species of animals as food for the unweaned young of another species.

Experiments concerning the use of milk from tuberculous cows with affected udders prove that such milk, after it has been pasteurized at 140° F. for 20 minutes, is absolutely safe.

OTHER WORK.

Various experiments on the symbiotic presence of two or more organisms in the bodies of animals have been continued, and a number of minor studies in the field of bacteriology conducted.

REPORT OF THE CHIEF OF THE BUREAU OF PLANT INDUSTRY.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
Washington, D. C., October 10, 1914.

SIR: I have the honor to submit herewith a report of the work of the Bureau of Plant Industry for the fiscal year ended June 30, 1914.

Respectfully,

WM. A. TAYLOR,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

GENERAL WORK OF THE YEAR.

Congress appropriated for the work of the Bureau of Plant Industry for the year which ended June 30, 1914, the following amounts: For statutory salaries, $427,690; for the prosecution of work upon the numerous and varied problems connected with the production and utilization of crops and the development of improved methods of farming included in the investigational and demonstrational projects of the bureau, $1,944,305; for the congressional seed distribution, $296,000. Under the miscellaneous provisions of the appropriation act there was assigned to the bureau for administration a special appropriation of $70,000 for the investigation of the parasitic fungus causing the chestnut bark disease, making the total appropriation administered by the bureau during the year amount to $2,737,995.

The correspondence of the bureau is constantly on the increase, more than 1¾ million letters, including letters printed on duplicating machines, having been sent out during the year.

The manuscripts for publication, as has been true for a number of years past, have been handled by Mr. J. E. Rockwell. New bulletins, circulars, etc., to the number of 109, containing 2,324 pages, 176 full-page plates, and 496 text figures, were issued during the year. The first editions of these publications aggregated 1,376,600 copies. Five papers were contributed to the Yearbook of the Department of Agriculture, all of which have been reprinted in separate form for special distribution, and 20 Farmers' Bulletins were prepared and submitted.

In connection with the fiscal operations of the bureau 8,753 requisitions for supplies were issued, 24,411 accounts were received

and examined, 181 requests for contracts and leases were made, and 2,621 letters of authorization and amendments thereto were drawn.

From September 1, 1913, to August 31, 1914, the changes in the personnel of the bureau were as follows: Resignations, 587; deaths, 12; transfers from the bureau, 58; furloughs and terminations of appointments, 1,373, making a total of 2,030 employees dropped from the rolls during that period. There have been made in the same period 2,369 appointments, increasing the total force of the bureau by 339. On September 1, 1914, the numerical strength of the bureau was as follows: In Washington, 912; outside of Washington, 2,156; total, 3,068. The total number of employees in the bureau on the same date a year ago was 2,729.

In the interest of brevity no attempt is made in this report to outline the full work of the bureau. Much of the investigational work under way is of such character as to require years of effort on the part of those prosecuting it to bring it to full fruition. Certain of the more striking results that have become evident during the year are briefly noticed, without undertaking to associate them directly with the particular administrative groups of the bureau organization which have been responsible for their accomplishment and which are shown in connection with the several publications in which the details of these results are reported.

PATHOLOGICAL INVESTIGATIONS.

The prosecution of the pathological work of the bureau during the year has continued under the following personnel: Dr. Erwin F. Smith, in charge of the general pathological laboratory; Mrs. Flora W. Patterson, in charge of pathological collections; Mr. M. B. Waite, in charge of fruit-disease investigations; Dr. Haven Metcalf, in charge of forest pathology; and Mr. W. A. Orton, in charge of the work on cotton, truck, and sugar-beet diseases.

Crown-gall.—Special attention has been given to crown-gall and its relation to cancer in man and animals. Experimental work with cold-blooded animals, using different strains of the crown-gall organism, is still under way. An exhibit and an address were solicited by the officials of the Seventeenth International Medical Congress, held in London in August, 1913.

Apple powdery mildew.—The researches on this mildew, carried on mainly at Watsonville, Cal., in cooperation with the county entomologist, have resulted in a practical method of controlling this disease. Pruning out the affected tips of the twigs and thorough spraying with an iron-sulphid spray, devised for the purpose, check the development of the mildew. A Department Bulletin on this subject has been issued. In connection with this work, some interesting discoveries were made by Mr. W. S. Ballard, in cooperation with Mr. W. H. Volck, on the beneficial effects of dormant winter spraying with nitrate of soda. A paper describing these results was printed in the Journal of Agricultural Research.

Peach leaf-curl.—In the spring of 1914 this disease was unusually abundant and severe in its attacks. This outbreak, together with an outbreak of pear blight, which is probably the greatest in the his-

tory of this disease, has caused a very pronounced increase in the amount of correspondence.

STIGMONOSE OF DECIDUOUS FRUITS.—The aftereffect of the work of particular insects on the various stone and pomaceous fruits is being studied. Part of this work is being conducted in cooperation with the Bureau of Entomology.

CRANBERRY DISEASES.—A special study is being made of blossom end-rot in Massachusetts and the possibility of its prevention by spraying with Bordeaux mixture. Two new fungous diseases of the cranberry have been discovered, one native to the Pacific coast, the other obtained from Massachusetts. For the first time the Wisconsin false blossom has been found in the East.

CITRUS CANKER.—A feature of the year's work in citrus diseases has been the appearance at several points in Florida and along the Gulf coast to Texas of a new citrus canker supposed to be of Japanese origin. A Farmers' Bulletin on citrus diseases is in preparation. The citrus-knot studies have been continued, the disease having been discovered on the sour orange.

SUGAR-BEET DISEASES.—Studies of the four fungi causing damping-off of sugar-beet seedlings have been nearly completed. One, *Phomo betae*, has been found to be a very serious parasite on the sugar beet in America because of its universal presence upon the beet seed and its ability to cause not only a damping-off and root sickness, but also a field rot and a storage rot. Another, Rhizoctonia, has been found to be not only a serious beet-seedling parasite, but also the cause of a very aggressive and destructive type of root-rot in many of the heavier soils of the West.

GINSENG DISEASES.—The work on diseases of ginseng has been continued under cooperative relations with the Cornell University Experiment Station and with the experiment stations in Wisconsin and Michigan. Methods of soil sterilization for the control of the damping-off of seedlings and of the nematode diseases of ginseng have been worked out. A Farmers' Bulletin on the diseases of ginseng and their control has been prepared.

SWEET-POTATO DISEASES.—A technical study of the stem-rot of sweet potatoes has been completed. Tests of a number of varieties to determine their resistance to this disease have shown that several are somewhat resistant. This line of investigation is to be continued. The foot-rot organism, the cause of a new and destructive disease of sweet potatoes, has been identified and the results of the investigations published. Successful methods of controlling the diseases of sweet potatoes have been demonstrated to the growers, and a publication on the subject has been issued.

POTATO DISEASES.—The discovery of powdery scab in Maine, where it has proved more serious than in Europe, has made it necessary to investigate this disease thoroughly. The disease does not seem to have secured a foothold outside of the district now under quarantine. It is expected that a successful method of seed treatment will be developed as a result of this year's experiments with control measures.

COTTON DISEASES.—The propagation of a new wilt-resistant variety of cotton suitable for boll-weevil conditions has been continued in South Carolina and Georgia with encouraging results. One hybrid made in 1904 between Dixie and Triumph has been found to be the most uniform of all yet secured, and, besides being highly wilt resistant, is more productive, has larger bolls, a higher percentage of lint, and is earlier than Dixie.

LOOSE SMUT OF WHEAT AND BARLEY.—An investigation of the treatments of barley and wheat for the prevention of loose smut was conducted at the Minnesota Agricultural Experiment Station. A practical method of seed treatment, however, has not yet been worked out.

BUNT, OR STINKING SMUT, OF WHEAT.—Investigations in the physiology and methods of preventing stinking smut of wheat have progressed far enough to show a definite relation between soil temperature, moisture conditions, and severity of the disease. It has also been demonstrated that the smut organism hibernates successfully in the soil of the Pacific Northwest and is thereby responsible for smut epidemics in fields sown with treated seed. Investigations are now in progress to determine the efficacy of crop rotation in ridding soil of the smut.

DISEASES OF FOREST AND SHADE TREES.—A number of new diseases of forest and shade trees have been noted and many observations made on the occurrence and range of diseases already known. The following diseases are believed to have been newly imported, and hence to be potential sources of danger: The Scotch pine stem blister rust (*Peridermium pini*), from Europe; *Gymnosporangium chinensis* and *G. japonicum* on *Juniperus sinensis*, from Japan; an unidentified canker on chestnut, from Japan; an undescribed twig disease of rhododendrons, from Europe; an undescribed disease of hornbeam, from Europe. *Coleosporium sonchi-arvensis*, from Europe, has been found established in one locality.

SMELTER INJURIES.—Investigations of injuries to trees by sulphur and other smelter fumes have been limited to laboratory studies and certain field studies in the vicinity of Ducktown, Tenn., and Berlin, N. H. This work has been utilized in expert testimony in two damage suits involving State and national interests.

DISEASES OF FOREST NURSERY STOCK.—Field experiments, the experience of the Forest Service on a commercial scale, and the experience of the Dominion Botanist (Ottawa, Canada), the Vermont Agricultural Experiment Station, and others continue to confirm the efficiency of sulphuric acid as a fungicide in controlling the damping-off of coniferous seedlings, and of a modified watering treatment in controlling blight. These methods are now being applied at many new nurseries, and particularly upon different types of soil. The work is now largely concentrated at Garden City, Kans.

WHITE-PINE BLISTER RUST.—The disease has been located in two new localities, in which it has become established on both the white pine and Ribes. In these localities the rust has been eradicated so far as found. Experiments and field experience have shown that the fungous parasite does not overwinter on Ribes. The disease has been found on a new imported pine, *Pinus excelsa*.

CHESTNUT BARK DISEASE.—Work on this disease has continued along all possible lines. The investigators have confirmed the discovery of the real nature and origin of the disease by inoculations and by morphological, ecological, and cultural tests. The disease is not indigenous, but imported from eastern Asia in nursery stock. It has been proved that it is distributed through great distances by nursery stock and by infected nuts. It has been shown that nuts gathered from diseased trees and stored and shipped by ordinary methods transmit the disease. This fact is of special interest, as it greatly increases the liability of introduction of this disease into Europe. Investigation has demonstrated that the parasite is exceptional in its resistance to unfavorable conditions.

The officers of the bureau have destroyed, or cooperated in destroying, diseased nursery stock in many orchards and nurseries located outside of the present general distribution of the disease. The collection of data on all possible uses and opportunities for the sale of dead chestnut timber has been completed, and the results have been published in Farmers' Bulletin 582 and publications issued in cooperation with the States of Pennsylvania, New Hampshire, Massachusetts, and Virginia.

Tests to determine the immunity and resistance of chestnut varieties are under way and the breeding work is being continued. A variety of Japanese chestnut with sweet nuts has been discovered which is apparently immune.

PATHOLOGICAL PROBLEMS IN WOOD PRESERVATION.—Work in this line has been concentrated on studies of toxicity of wood preservatives under control conditions. A manuscript giving the methods and results of many hundreds of tests has been submitted for publication. Observations on the cause of decay in mining timbers have been completed and are being prepared for publication. These observations revolutionize our knowledge of this subject.

A general pathological survey has continued over the National Forests, bringing to light many facts new to science. Some of the more important results are substantial contributions to the knowledge of the life history of several heart, top, and root rots; discovery of four tree rusts new to science; completion of the life history of four other tree rusts; discovery of the cause of pecky cypress; and knowledge of the life history and identity of an undescribed oak twig disease. Work has continued in cooperation with the Forest Service and in connection with the "sanitation clause" in certain timber-sale contracts. Results to date indicate that the enforcement of the sanitation clause can be made not only without loss but with actual profit. These results are being compiled for publication.

MYCOLOGICAL WORK.—In addition to the purchase of current American and foreign sets of exsiccati, the collections secured include certain old and rare sets. The systematic insertion of specimens of fungi is well up to date and conveniently accessible for consultation.

A large collection of plants, examples of so-called physiological diseases, has been systematically arranged and indexed, and is now available for study.

The increase in the number of permanent slides has been marked, and the collection provides a valuable means for the study and comparison of species.

INSPECTION WORK.—Close inspections have been made of all plant material imported by the United States Department of Agriculture. In addition to such importations, the inspectors have been called on to examine consignments for colleges, experiment stations, and private individuals. All plants intended for distribution have received similar critical inspections. Many new, undescribed, and evidently parasitic fungi have been observed and their introduction into the country prevented.

NEMATODES.—The study of the life history of the new citrus parasite *Tylenchulus semipenetrans* has been continued, and an article has been published in the Journal of Agricultural Research giving the morphology and life history of this nematode. The investigations have shown this parasite to exist in many different parts of the world, probably wherever citrus trees have been grown for any great length of time.

An examination of imported beet seed revealed the presence of several different nematodes upon the seed balls or in the particles of soil associated with them. Although there were traces of the beet nematode *Heterodera radicicola*, there were no living specimens of this species found associated with the beet seed at the time of the examination.

PHYSIOLOGICAL AND BIOPHYSICAL INVESTIGATIONS.

The personnel of the force devoting its attention to the investigation of physiological and biophysical phenomena has remained the same as last year, with Dr. R. H. True and Dr. W. W. Stockberger in charge of drug-plant, poisonous-plant, physiological, and fermentation investigations; Dr. W. W. Garner in charge of tobacco investigations, which include important physiological studies essential to the working out of satisfactory production, curing, and handling methods; Mr. W. T. Swingle in charge of crop physiology; Mr. K. F. Kellerman in charge of soil bacteriology; Mr. T. H. Kearney in charge of alkali and drought resistant plant investigations; and Dr. L. J. Briggs in charge of biophysical investigations.

PHYSIOLOGICAL STUDIES ON MOLDS AND PARASITIC FUNGI.—The work on molds growing on maize has been continued, with special attention to *Aspergillus flavus*, which is found to be toxic. An apparently new organic acid has been isolated from pure cultures of this mold.

Investigations directed toward a better understanding of the metabolism of parasitic fungi have shown that a considerable group of substances concerned either in the make-up of the cell wall or of related structures is dissolved by one of the common parasitic fungi and utilized for food purposes by the fungus, this result being accomplished through the agency of enzyms which it forms. This work makes clear the reason for the great efficiency of attack shown by organisms of this class.

Through the investigations of the chemical and physiological modifications produced in the chestnut-tree bark through the presence and activity of the blight-producing organism it has been shown that the metabolism of the chestnut tree is greatly modified by the action of the parasite as reflected in the biochemical characteristics of the host plant.

Drug plants.—The number of species of drug plants being tested has been increased and permanent planting are being made, which will furnish authentic material for standardizing crude drugs grown in the United States. The work of improving belladonna by breeding and selection has continued to yield gratifying results.

The work in Florida has been enlarged as an incident to the transfer of the station from Orange City to Orlando. As a direct outcome of the work of this office on camphor growing three large commercial enterprises have been undertaken, one of which produced 10,000 pounds of crude camphor in 1913. Because of this commercial development the emphasis of the work has shifted from the purely cultural aspect to that of improvement by selection and breeding and the development of special machinery.

Poisonous plants.—The work of poisonous-plant investigations has been continued in field and laboratory, special attention having been given to species of death camas, larkspur, and lupine. The work with larkspurs has shown that the species occurring in the mountain stock ranges are dangerous only to cattle and that horses and sheep can be grazed on these larkspur areas without loss.

In the present state of knowledge concerning loco weeds the only way of determining which species are poisonous is by a series of experimental feedings. Loco work during the past season contributed further information on one harmful species; it also demonstrated that three other species, heretofore suspected, are harmless. The study of poisonous molds has been taken up, with special reference to the organisms which produce poisonous results in grain and hay.

Hops.—The fertilizer work on hops gives promise of important commercial results. Certain combinations of fertilizers appear to produce hops having an unusually high percentage of dry matter, or, conversely, which lose a smaller percentage of moisture on drying. The net gain in the dry weight of the hops on the fertilizer plat over those on the check plats has averaged 16.5 per cent. The experiments along this line, however, are not yet completed.

Tobacco investigations.—In New York and Pennsylvania it has been shown that both the yield and the quality of the tobacco crop are improved by the use of potash and phosphoric acid as a supplement to barn manure. Excellent results have been obtained in the use of better methods of handling tobacco seed beds, especially in sterilizing with steam. In Maryland further tests with the Maryland Mammoth and other new types produced by breeding leave no doubt as to the superiority of these over the old standard tobacco varieties. Experiments in the dark-tobacco districts of Kentucky and Tennessee show that the profit from the tobacco crop can be very much increased by the more liberal use of suitable phosphates, particularly when combined with soil-improving crops in rotation.

It has been found that the number of leaves produced by the plant is independent of soil and climatic conditions, including water supply, temperature, and light intensity, whereas the size, shape, and texture of the leaf, all of which are of great practical importance, can be greatly modified by conditions more or less under the control of the grower.

ALKALI AND DROUGHT RESISTANT PLANT INVESTIGATIONS.—The indicator significance of different types of native vegetation with respect to the alkali content, moisture relations, and crop-producing capabilities of the land have been further investigated in portions of Utah and Nevada, and the correlations previously established in Tooele Valley have been found to hold good, with comparatively little modification, throughout an extensive portion of the Great Basin.

EGYPTIAN COTTONS.—The new Pima variety of Egyptian cotton developed in these investigations has shown itself to be productive, early, large bolled, and long of staple (1⅝ to 1¾ inches), and promises to become an important factor in long-staple cotton production on the irrigated lands of the Southwest. Of the older Yuma variety, which is now being grown commercially in Arizona, about 13,000 acres were planted in the Salt River Valley in 1914.

MOISTURE CONTENT OF GRAIN.—A commercial test of an electric method of measuring the moisture content of grain in shipment, developed in the biophysical laboratory, has been made on consignments of grain passing through Baltimore. The method is used satisfactorily with corn and is now being tested with wheat.

SOIL-BACTERIOLOGY INVESTIGATIONS.—In accordance with the policy of the last few years, pure cultures of nodule-forming bacteria for inoculating approximately 75,000 acres of leguminous crops were distributed during the fiscal year 1914.

Investigations of the bacterial flora at Riverside, Cal., have shown the existence of a very direct relationship between certain groups of soil bacteria and the development of chlorosis in the orange groves. Methods of ameliorating the malnutrition in certain areas by the use of small quantities of straw instead of mineral fertilizers have been developed.

PLANT-NUTRITION INVESTIGATIONS.—It has been shown that the oil content of seeds is very greatly influenced by soil and climatic conditions, and good progress has been made during the year in determining the particular factors of the environment most concerned in producing high yields of oil.

TECHNOLOGICAL INVESTIGATIONS.

Investigations which have to do with the handling of agricultural products in the trade or in process of manufacture are, for convenience, denominated technological investigations. The personnel of the bureau charged with this line of work has been changed during the year but slightly, Dr. N. A. Cobb continuing in charge of crop technology and cotton standardization; Mr. Charles J. Brand, of the Office of Markets, in charge of paper-plant investigations, the work in cotton marketing having been transferred to the Office of Markets; Mr. L. H. Dewey, in charge of fiber-plant investigations; Dr. J. W. T. Duvel, in charge of grain standardization; and Mr. Edgar Brown, in charge of the Seed Laboratory.

GRAIN STANDARDIZATION.—Investigations pertaining to the conditions affecting grain crops after production, i. e., the methods of harvesting, grading, transporting, and marketing corn, wheat, oats, rice, barley, and other grain crops, have been continued throughout

the year. Tentative grades for corn, formulated by the department, were published August 22, 1913. These grades were presented informally to the grain trade on October 15 at New Orleans and on October 21 at Des Moines, Iowa, these meetings being under the auspices of the Grain Dealers' National Association and the National Council of Farmers' Cooperative Associations, respectively. A formal hearing was given in Washington, October 29, 1913, for the consideration of these grades, and on January 3, 1914, these tentative grades, with some slight changes made at the suggestion of the grain trade, were promulgated by the department as "Grades for commercial corn," to take effect July 1, 1914. The various State inspection departments and independent commercial organizations having independent grain-inspection departments have either adopted the Government grades or declared their intention of doing so. The specifications for these grades, being capable of definite interpretation, will enable the shipper of grain to determine for himself what grade to expect when the corn reaches the inspection point, and the buyer to determine for himself whether or not he has received the grade he contracted for. It is also expected that these grades, when applied, will place a premium on good farm methods and practices, which is the reverse of what has been true in the past, the common practice having been to pay practically the same price for all corn delivered at country stations, regardless of its water content or its soundness. Moreover, it is confidently expected that they will create a much higher standard of transactions in grain and that a No. 3 or lower grade will be offered for sale when No. 2 is not available, instead of varying the interpretation of the grades at different seasons of the year, which has been a common practice heretofore.

These grades for corn, as fixed, represent the quality and condition of corn as delivered at country elevators and as received at country markets before it has been manipulated in any way. They have likewise been fixed on such a basis that the difference in intrinsic value between the different grades is practically uniform.

Commercial grades for grains other than corn will be fixed as soon as the necessary data can be secured on which they may be based according to intrinsic value with scientific accuracy. This work, especially that with wheat, will be pressed vigorously during the present year.

In order that the specifications in these grades may be uniformly interpreted in the various sections of the country and that there may be a central authority for the settlement of disputes as to grade, there should be some suitable Government supervision of grain inspection. To accomplish this, additional legislation is necessary.

The acidity test, which has been found to constitute a definite determination for soundness in corn, has been extended to wheat and oats and promises to be equally effective with these grains.

Provision has been made for the establishment during the coming year of a grain-standardization laboratory at Portland, Oreg., for the purpose of making a study of the commercial practices of grading, handling, storing, and transporting grain on the Pacific coast.

A number of shipments of corn from Argentina have been received in this country during the year, and this corn has been sampled, tested, and analyzed, in order to determine its value as compared with American corn.

COTTON STANDARDIZATION.—The preparation of official cotton grades has continued, and their distribution has covered practically the same territory as heretofore. Recently the State of Texas passed a law directing the purchase of a set of the official grades by each county 10 per cent of whose cultivated land is planted to cotton. These sets are to be placed in charge of the county superintendents of schools and are to be used for instruction in cotton grading in the public schools.

It is believed that technological investigations have shown the possibility of the establishment of satisfactory standards for length of cotton staple.

The vacuum storage system, which has proved successful with white cotton, bids fair to be even more so with the fleeting colors which characterize some kinds of tinged and stained cotton.

SPINNING TESTS.—In accordance with the terms of the appropriation act, spinning tests have been carried out in connection with the official grades of cotton in order to ascertain what is the normal waste, tensile strength, and bleaching quality of cotton of each of the official grades. The first series of tests included only the five full grades. Samples of the cotton purchased were sent to the principal cotton exchanges for their opinion with regard to the suitability of the cotton for these tests, which was uniformly favorable. The greatest care was exercised to use thoroughly representative cotton in the tests. After purchase, the cotton was stored for several months to allow it to come to uniform condition. The experiments were carried out successfully at a large, modern cotton mill, as well as at textile schools, and a preliminary report upon the experiments has been issued. The crop of 1913, which was utilized in these tests, was an average crop, so that the first year's results are regarded as distinctly significant, although it would be unwise to assume that the results are final until the cotton of several different seasons has been tested.

HEMP.—Hemp growers have repeatedly stated that this department can best aid the industry by making it possible to secure an adequate supply of good seed.

In 1913 about 15 acres were planted by hemp-seed growers in Kentucky with seed of the Minnesota No. 8 variety, developed by the Minnesota Agricultural Experiment Station in cooperation with this bureau. The plants were in every instance decidedly superior to other seed hemp, and a large proportion of the seed-hemp crop of 1914 is of this stock, while some was sown broadcast for fiber.

An importation of a few ounces of Chinese hemp in 1910 (S. P. I. No. 26841) has been grown and increased in Kentucky and is now recognized as a variety of superior merit.

FLAX.—All fiber flax in this country is grown from imported seed. The most important problem of this industry is to obtain an adequate and dependable seed supply of proper quality.

Improved types of flax plants, taller, more uniform, with fewer branches and with stronger stalks, are being developed by plant breeding.

The experiments and tests thus far made have clearly demonstrated that the blue-blossom strains of flax are much superior to white-blossom varieties for fiber production, but no commercial lots of

flax seed have been found to be entirely free from seed of white-blossom plants.

SEED TESTING.—At the Washington laboratory 4,305 samples of seeds have been received from farmers and seedsmen. Of these, 2,207 have been tested for mechanical purity, and practically all have been tested for germination.

At the five cooperative laboratories 6,937 samples have been received and tested, the number varying from 876 in Louisiana to 1,788 in Indiana.

In connection with the congressional seed distribution and the Office of Foreign Seed and Plant Introduction, 952 samples have been tested. For other offices of the Department of Agriculture 5,961 samples of seed, not representing commercial lots, were tested for germination.

Identifications were made of 380 specimens of plants and seeds received for that purpose.

ADULTERATED SEED.—In carrying on the work on adulterated seeds 1,470 samples of Kentucky bluegrass, orchard grass, hairy vetch, and sweet clover were collected and examined and will be reported on later. A preliminary examination indicates that the quality of hairy-vetch seed has greatly improved since it was previously collected. Seed of the yellow-flowered biennial sweet clover has frequently been sold for that of the white-flowered biennial, the latter being usually preferred. In a number of cases the small annual yellow-flowered species has been sold either for the yellow-flowered or for the white-flowered biennial. Of the seed reported on in 1913 only 4 per cent of the Kentucky bluegrass and approximately 20 per cent of the redtop was adulterated or misbranded.

SEED IMPORTATION ACT.—In connection with the enforcement of the seed-importation act, 815 lots were sampled by customs officials, of which 24 were prohibited entry. Of these, 9 were recleaned in bond, 9 were returned to the country of origin, 1 was denatured, and 5 are pending. It is becoming a general practice for dealers in the United States to buy seeds subject to the act.

IMPORTED SEEDS.—Aside from the enforcement of the seed importation act, 2,490 samples of imported forage-plant seed have been received through the Customs Service and examined. The source of imported alfalfa seed has been studied. Practically all the seed now coming into this country is commercial Russian Turkestan seed which is not adapted to general use. Easy means of identifying it have been published.

SEED VITALITY.—The investigations on methods of seed germination and the practical value of "hard" seeds have been continued, and reports for publication are nearing completion.

STOCK-FOOD EXTRACTS AND PAPER FROM CORNSTALKS.—The fiscal year 1914 marked the completion of work for obtaining stock-food extracts from cornstalks by diffusion. In the laboratory, by means of an experimental 12-cell diffusion battery, extracts were secured which contained up to 20 per cent of soluble solids, 38 per cent of which was sugar and 11 per cent protein.

On account of these encouraging results a commercial test was made in a sorghum diffusion mill at Fort Scott, Kans. Cornstalks

for the test were secured from a section of Indiana where material had previously been obtained, but, unfortunately, weather conditions for field curing were the worst that had obtained for many years, so that the extract secured contained barely 5 per cent of sugar. The very low yield and low grade of the extract finally obtained indicated that the production of extracts can not be depended upon to assist in making cornstalks a practicable material. The results of the experiments to date on cornstalks are being incorporated in a formal report.

A part of the extracted stalks from the Kansas experiment were later converted into low-grade wrapping paper, with promising results. It appeared, however, from present market conditions, that wrapping stock could not be manufactured cheaply enough from cornstalks to warrant such utilization at this time.

Sorghum bagasse as paper stock.—Two tons of sorghum bagasse, the waste product of the sorghum-sirup industry, were tested in a commercial way in a strawboard mill at Coffeyville, Kans. The test was successful, and manufacturers pronounced the board suitable for certain classes of commercial work.

Hemp products for paper making.—Various hemp products, including line, tow, flying, and stalks, fresh, retted, and unretted, were subjected to semicommercial tests in regard to their paper value. Very promising results were obtained, the papers being very soft and of good white color. If properly employed with fiber of different quality, hemp products should yield suitable printing and book papers. It appeared from the tests that certain of these products might with advantage be treated differently for the manufacture of far higher grades of paper. Indeed a paper was made from the flyings which was a very close approach to the thin, soft, opaque "Oxford" or "Bible" papers which are so highly prized.

Semicommercial tests of flax straw for paper making.—Three large tests were conducted at a cooperating paper mill at Cumberland Mills, Me., in an endeavor to produce a printing or writing paper. The early results were not encouraging. Later experiments, both in the laboratory and in the mill, have yielded such promising results that special attention is now being devoted to the manufacture of high-grade board stock suitable for shoe counters, toes, and strong wrapping stock, possibly suitable for cement sacks.

AGRONOMIC INVESTIGATIONS.

The agronomic work of the bureau has continued under the same direction, with one exception, Mr. M. A. Carleton having again taken up the administration of cereal investigations in place of Mr. C. R. Ball, who was acting in charge of the work during the previous year; Mr. C. P. Hartley has been in charge of corn investigations; Dr. O. F. Cook in charge of work on cotton breeding and crop acclimatization; Prof. C. V. Piper in charge of forage-crop investigations; Prof. E. C. Chilcott in charge of dry-land agriculture investigations; Mr. C. S. Scofield in charge of western irrigation agriculture; while Mr. E. C. Butterfield has directed the work at the Arlington farm.

WHEAT CULTURE.—Preliminary tests have been made of a method of wide spacing drill rows so that wheat may be cultivated in the same manner as corn. The alternation of wheat and fallow is a common practice in certain dry-land areas, but intertillage provides both crop and fallow on the same field each season. The results of these preliminary tests indicate that this method may produce profitable crops where the ordinary close drilling does not succeed, especially in unfavorable seasons.

WINTER CEREALS FOR THE SOUTH.—During the year there has been a marked increase in the interest in winter cereals in the Southern States. Pure varieties of wheat, oats, and barley adapted to the South have been developed and distributed, with the result that centers for the distribution of good seed are being established.

WEEDS IN RICE.—The work of the year has shown that the worst weeds of rice fields are readily controlled by growing cultivated crops in rotation with rice. As these crops can only be grown successfully in well-drained areas, the necessity for good drainage is apparent.

SUDAN-GRASS INVESTIGATIONS.—Both in dry-land farming and under irrigation, Sudan grass produces large crops of excellent quality, and it appears destined to become the most important grass hay of the semiarid region. Owing to the remarkable results secured with it, seed has recently been held at an exorbitant price, but as the grass produces seed in abundance and as a large acreage has been planted during the present season there should in future be an ample supply available at very moderate prices.

Further investigations of the wild sorghums scattered over Africa indicate that from the Sahara Desert southward there are about 12 distinct varieties. Seed of a number of these has already been obtained, and it is altogether likely that several of them will be found to have economic value comparable to that of Sudan grass. Particular interest attaches to those which occur in the more humid portions of Africa, as it seems likely that these will be better adapted to the humid conditions of the Southern States than Sudan grass, which thrives best under semiarid conditions. Extensive investigations are under way with these wild sorghum grasses, and a number of hybrids between them and Johnson grass have been obtained.

The only disease that has caused any important injury to Sudan grass is red-spot, or sorghum blight. By selection, strains strongly resistant, if not quite immune, to this trouble have been secured.

SORGHUM.—Among the numerous varieties of sorghum introduced from Africa, several have proved of sufficiently high value to justify the distribution of the seed on a large scale. The most striking of these varieties is feterita, which during the exceptionally dry season of 1913 made satisfactory crops of grain and forage, while other varieties under the same conditions failed to head.

SOY BEANS.—A few sorts of soy beans secured from northern Manchuria have given considerable promise in South Dakota, Wisconsin, and New York. During the last winter about 300 varieties were secured from Chosen (Korea) and northern Manchuria. It is believed that with these new introductions the area over which the soy bean can be grown profitably will be extended much farther northward.

PERUVIAN ALFALFA.—In the South and Southwest, Peruvian alfalfa and similar strains are becoming generally popular and promise to replace the common varieties that have been grown in that region. The Peruvian alfalfa in the South has shown more disease resistance than the common strains, and definite experiments are being conducted at the various State experiment stations.

PURPLE VETCH.—In California and Oregon the purple vetch (*Vicia atropurpurea*) has proved to be exceptionally valuable. In the Willamette Valley, Oreg., it produces larger crops of seed than common vetch, and as a green-manure crop in the citrus regions of California has proved to be somewhat superior to common vetch. These traits have made the plant popular, and seed is now being grown in large quantities in Oregon.

Low-priced machines are now on the market by which seed of hairy vetch can be readily separated from rye or other grain, and this has led to the increased production of American-grown seed.

CACTUS INVESTIGATIONS.—During the year the varietal collections of cacti formerly maintained at San Antonio and Brownsville, Tex., have been transferred to Chico, Cal., where varietal studies are now concentrated. In the study of native species and in explorations, three species have been secured which are thought to be of much economic importance. These are remarkably smooth for native forms and remain so under cultivation; they grow as rapidly as the average species of Texas and will be hardy in the San Antonio and Austin regions. There is promise through these selections of increasing the cold resistance of the conventional spineless species 10 or 15 degrees and possibly 20 degrees. They are the most promising source of hardiness for the improvement of the conventional spineless species now in the trade that has yet been discovered.

SUGAR-CANE INVESTIGATIONS.—A survey of the principal cane-producing districts in the United States regarding methods of production, handling, and utilization and a study of the relative cost of production of sugar cane and sugar-cane products in this country and in foreign countries have been made. Field observations of the principal sugar-cane diseases existing in the United States have been made.

COTTON FARMING IN THE SOUTHWESTERN STATES.—There is no longer any doubt of the possibility of developing a new cotton industry in the Southwestern States beyond the supposed limits of the cotton belt. The dry climate affords protection against the boll weevil and allows the cotton to be harvested and sent to market in better condition. These advantages compensate for the higher costs of labor and transportation, and the natural conditions make it possible to produce fiber of high quality that will command special prices in the market instead of competing with the Upland short staples of the eastern cotton belt. But in order to produce fiber of high quality skillful farming is necessary and special precautions must be taken to preserve the purity and uniformity of varieties. The agricultural and commercial problems of the new industry are being solved through cooperative organizations of growers.

LONG-STAPLE COTTON IN THE SOUTHWEST.—In the Salt River Valley in Arizona during 1913, 3,500 acres were devoted to the produc-

tion of long-staple cotton of the Egyptian type. The total crop from this acreage amounted to about 2,200 bales, which sold at very satisfactory prices. In the Imperial Valley of California about 5,000 acres were devoted to the production of Durango long-staple Upland cotton, and it is estimated that something over 5,000 bales of this type of cotton were produced. In both places the acreage devoted to these crops for 1914 was materially increased.

Advantages of late thinning of cotton.—The later thinning of cotton, which has been under investigation for several years, proves to have several important advantages in addition to the suppression of the vegetative branches. The young plants make more rapid growth when they are allowed to stand close together for mutual protection against unfavorable conditions. Extremes of temperature, dry winds, and blowing sands often injure or destroy cotton seedlings. Early thinning increases the exposure to those dangers and also induces more severe attacks of the peculiar disorder known as leaf-cut or tomosis. With thinning deferred until after the period of leaf-cut injury, the injured or stunted plants can be removed, to the advantage of the crop. Later thinning also tends to prevent the growth of weeds along the rows.

Single-stalk cotton culture.—A new system of cotton culture is being developed and applied, as affording the best means of securing earlier crops and larger yields. It is adapted especially to short-season conditions and to regions infested by the boll weevil. The beneficial effects are obtained by suppressing the vegetative branches or secondary stalks that arise from the base of the plant. This permits a better development of the lower fruiting branches, those that produce the early crop. The suppression of the vegetative branches is easily accomplished by thinning later and leaving the plants closer together in the rows than has been customary in the past. Striking differences are shown when the new and old systems are applied to adjoining rows. In all cases where the methods have been properly applied, earlier and larger yields have been obtained, the rows treated by the new system often exceeding the others by 30 to 50 per cent.

Agriculture on reclamation projects.—The more conspicuous features of the investigations and experiments to determine the best utilization of lands reclaimed under the reclamation act have had to do with—

(1) A general movement to encourage the production of live stock on the reclamation projects.

(2) Further activity in connection with establishing the production of long-staple cotton on the southwestern irrigated lands.

(3) The consummation of experiments in the utilization for crop production of alkali lands on two of the northern projects.

In addition to these definite movements, the regular investigational work of the field stations has been actively carried on, and the investigational work in cooperation with other offices of the bureau has progressed satisfactorily and with good results.

The utilization of alkali lands.—On several of the projects on which field stations are maintained by this office there are large tracts of land too salty to be used for crop production. This has been par-

ticularly true on the Huntley project and on the Truckee-Carson project. Experiments have been under way for several years in each of these cases to determine the best methods of reclaiming and utilizing these lands. The work on the Truckee-Carson project has taken the direction of drainage and the application of gypsum and other chemicals to render the soil more permeable. On the Huntley project it has been shown that the use of green-manure crops and alternate light irrigation and cultivation have been successful in reducing the salt content to a point where the production of profitable crops is possible.

Encouraging the production of live stock.—It has become increasingly apparent that the establishment of a successful agriculture on many of the reclamation projects must depend largely upon live-stock industries. Conditions on many of these projects favor the production of forage crops, which are too bulky to be transported long distances, but which may with economic advantage be converted into meat and dairy products. In order to develop these live-stock industries it has been necessary to foster the organization of the farmers in such a way as to provide suitable credit for securing capital with which to purchase live stock. Several of these credit associations have been formed through the cooperation of local bankers and leading citizens, and purchases of live stock have been made. It has also seemed necessary to demonstrate the most economical and effective method of utilizing the forage crops produced. In this connection, emphasis has been placed upon demonstrating the possibility of producing pork cheaply through alfalfa pasturing supplemented by an economical grain ration. These demonstrations have been conducted at Scottsbluff, Nebr., Belle Fourche, S. Dak., and Huntley, Mont.

In connection with the production of long-staple cotton in the Southwest, also, it has been found necessary to get the farmers organized in such a way as to avail themselves of satisfactory credit. In connection with the work of this bureau and the Office of Markets, both in the Salt River Valley and in the Imperial Valley, arrangements have been perfected by the farmers, through associations, for securing money at very reasonable rates. After the crop has been produced and ginned, arrangements have been made for storing it in warehouses or suitable yards, where warehouse certificates can be issued against it, to serve as collateral for loans at very low rates of interest until the cotton is finally marketed.

Pork from alfalfa.—A test carried on at the Huntley station to determine the advisability of pasturing alfalfa with hogs shows that hogs turned on alfalfa pasture August 7, 1913, where they were kept 51 days, produced a net return during this period of $31.88 per acre. This return was from the third crop, the first and second crops having been cut for hay. This experiment has been continued during the present season. Hogs were turned on alfalfa pasture April 27. Up to June 30 they had made satisfactory gains, the net return per acre averaging 50 cents per day.

Dry-land agriculture investigations.—There has been a steady enlargement of this work, as shown not only by the establishment of new independent stations, but also by undertaking cooperative

work at new State substations and the enlargement of the field at those substations where work has been under way for a number of years.

The new Woodward field station.—A new field station has been established at Woodward, Okla. About 120 acres of land have been planted and cropped during the present season. A commodious and well-equipped office and laboratory building, a large barn and implement shed, and a comfortable superintendent's residence have been erected. The investigational work contemplated at this station is well under way.

The northern Great Plains field station.—The buildings on the northern Great Plains field station at Mandan, N. Dak., are nearing completion; the roofs, floors, and inside finish of the seed house and assistant superintendent's residence will be completed in the fall of 1914. This will complete the work of construction at that station for the present.

A new cooperative station at Colby, Kans.—A new substation has been established at Colby, Kans., in cooperation with the Kansas Agricultural Experiment Station. The major problems at this substation are closely related to soil blowing, and it is believed that crop-rotation investigations will be of special value here, where continuous cropping to wheat has brought about such a condition that large areas have been abandoned on account of soil blowing.

Arlington farm.—Soil and general improvement work in connection with the development of the farm, as previously outlined, has been continued. The greenhouse space and the greater part of the farm area have been devoted to the experimental work of the various offices of the bureau. Special attention has been given to drainage, heating and water systems, and the improvement of the farm roads. The subject of concrete construction of farm buildings has received considerable attention. A small, fireproof, one-story, concrete building for the storage of oils and other inflammables has been constructed, a well drilled, a motor truck purchased, and much new equipment has been added.

Cooperative work on Indian reservations.—The culture of Egyptian cotton has been established as a profitable industry among the Indians and white settlers of the Salt and Gila River Valleys.

A serious obstacle to the establishment of this industry on a profitable scale has been the scarcity of competent labor for picking the crop. Egyptian cotton, because of its finer quality, requires better handling than ordinary sorts. The experience of the last year, however, has shown conclusively that Indians can be trained to do this work satisfactorily. Pima and Papago Indians earned more than $25,000 during the year picking Egyptian cotton for white settlers, while they received not less than $20,000 for cotton grown on their reservation farms and picked by the women and children while the men were helping the white settlers.

FARM-MANAGEMENT STUDIES.

The farm-management investigations have continued under the direction of Prof. W. J. Spillman. The work has developed several

clear-cut lines of investigation which have to do with the determination of the overhead charges involved in the development and maintenance of a farm, as well as the cost in terms of labor and expense of the production of all farm products.

FARM MANAGEMENT.—In cost-accounting work, the actual records kept on numerous farms throughout the country have been supplemented by two crop surveys to determine the cost of growing potatoes and apples. In the case of apples, the studies indicate that the cost of production is greatly influenced by the organization of the entire farm as a unit. Apples cost considerably more per bushel on specialized apple farms than on well-diversified farms where the production of this fruit is only one of the enterprises. With potatoes it was found that, whether early or late varieties were grown, the cost was quite generally in proportion to the returns received. To illustrate: The cost of growing late potatoes is approximately 30 cents per bushel, while the cost of growing early potatoes is nearly double this amount. The returns per bushel, however. are considerably less for late potatoes than for early potatoes, but because of the greater yields the returns from late potatoes per acre are practically the same as returns from early potatoes.

The farm-management surveys made during the year, taken in connection with previous surveys, indicate the leading factors in successful farming to be—

(1) The size of the farm business.

(2) The quality of the farm business, as shown by returns per animal unit and by crop yields.

(3) The diversity and stability of the enterprises, the latter being a measure of the way the farm is organized so as to utilize labor and machinery efficiently throughout the year.

Too great emphasis can not be placed on the second of these factors, namely, the quality of the farm business. This is particularly true in the case of dairy farms, where the dairy herd sets the price which the farmer receives for a large proportion of his crops.

Studies in 10 representative farm districts widely scattered, to determine what the farm furnishes during the year toward the family living, indicate an average annual cost of food per person on the farm of about $89, of which amount 63 per cent is furnished by the farm.

FARM DEMONSTRATION WORK.

Farm demonstration work adapts itself to all lines of activity carried on upon the individual farm. It also articulates with all of the investigational activities of the Bureau of Plant Industry. This work throughout the Southern States, which was inaugurated by Dr. S. A. Knapp, has, since his death, been carried on by Mr. Bradford Knapp, and the work in the Northern and Western States by Prof. W. J. Spillman, assisted by Mr. C. B. Smith.

DEMONSTRATION WORK IN THE NORTH AND WEST.—Demonstration work by means of county agricultural agents has been extended during the year into every Northern and Western State except four. Two hundred and forty-three of these agents are now at work in as many counties, distributed from New Hampshire to Oregon, the work

being carried on in cooperation with the State agricultural colleges. The plan of having a man well trained in both the practice and science of agriculture located in every agricultural county of every State is meeting with popular approval and support.

Up to the close of the fiscal year, 158 agents who had been at work for six months or more were cooperating directly with the farmers in the culture of 1,304,000 acres of corn, 866,000 acres of wheat, 961,000 acres of oats, and 969,000 acres of hay, of which 92,000 acres were alfalfa and 185,000 acres clover. Other demonstration crops grown were soy beans, cowpeas, sweet clover, potatoes, sugar beets, etc., making a total area of crops grown under the supervision of the agents of 4,278,424 acres. During the year the agents visited personally 62,036 farmers, cooperated directly with 12,677 farmers, organized 586 farmers' clubs and associations, addressed 4,152 farmers' meetings, and prepared 3,914 articles for the press, besides numerous special circulars and bulletins. The agents also influenced 266 boys to attend the State agricultural colleges, and 1,142 to attend the short courses at these colleges.

Along live-stock lines, there have been purchased, on the advice of the agents, 29 pure-bred stallions, 353 bulls, 14 rams, and 177 boars. In addition, 139 antihog-cholera clubs have been formed and 66,810 hogs vaccinated against cholera. Tests for efficiency were applied to 36,457 cows and 866 were tested for tuberculosis. In more than a dozen sections of the country the agents have rendered especially valuable service in the discovery of lime quarries and marl deposits and the organization of companies for their development as cheap sources of supply of lime to the farmers. Approximately 306,000 tons of lime have been used for agricultural purposes under the direction of the agents.

On the business side of farming, 4,660 farmers have been induced to keep accounts. The business done by the purchasing and marketing associations organized amounted to $1,131,391, with an approximate saving effected of $101,164. On 355 farms systems of farm accounting have been introduced, 2,303 farms have been analyzed with reference to the labor income of the farmer, 818 farm plans made, 845 rotations planned, and 373 drainage systems planned. Additional undertakings include public-roads improvement stimulated, farm-labor bureaus maintained, consolidation of country schools promoted, short courses held by county agents in their counties, reading courses established, laboratories for testing seed maintained, agricultural courses for rural schools outlined, short courses for countrywomen held in farm homes, county fairs revived and improved, and the like.

In a special survey made to determine the influence of a county agent who had been actively at work for four years in one of the Northern States, it was found that 40 per cent of the farmers of the county were following the advice of the agent along one or more lines, and that in the case of those whom he had personally met 86 per cent were following his advice. Of those who had received letters from him, only 70 per cent were following his instructions, while of those who had only read his articles in the local press but 28 per cent were following his advice—data which would seem to show the value

of the personal visit of the agent in getting things done and actually modifying agricultural conditions.

Boys' and girls' club work.—In the club work of the Northern and Western States there has been an enrollment of 110,077 boys and girls between the ages of 10 and 18. Of this number, 11,233 belong to the gardening and canning clubs, 8,584 to the potato clubs, 8,183 to poultry clubs, and 18,433 to corn clubs.

The champion corn grower was Arthur W. Runff, of Reinbeck, Iowa, with a yield of 136.7 bushels per acre. Next to this came the champion from New Hampshire, with a yield of 124 bushels per acre. Among the prizes awarded club members in various States were 1,156 free scholarships for short courses in agriculture at the agricultural colleges.

Demonstration work in the South.—Work in the South has been carried on directly with 33,276 adult demonstrators and 58,190 adult cooperators, while 40,015 boys and 28,563 girls were enrolled in the corn, cotton, kafir, and pig clubs and in the girls' canning and poultry clubs.

In the adult work, corn, cotton, kafir, milo, sorghum, ribbon cane, peanuts, soy beans, alfalfa, lespedeza, mixed hay, grasses, cowpeas, vetch, crimson clover, bur clover, red clover, Bermuda grass, Sudan grass, Irish potatoes, sweet potatoes, and various other crops were used as demonstrations.

For the crop season of 1913 the average yields on corn and cotton demonstration farms, computed from the reports of 26,881 demonstrators, reporting on 105,168 acres of cotton and 104,402 acres of corn, were 1,004.9 pounds of seed cotton per acre and 35.9 bushels of corn per acre. This exceeded the general average yield for the respective States by 458.9 pounds of seed cotton and 15.7 bushels of corn per acre.

Demonstrations in kafir, milo, feterita, etc., were confined to Oklahoma and western Texas, the object being to show that these crops are more dependable for this section than corn. Very gratifying results were obtained. Notwithstanding an extremely unfavorable season, kafir demonstrations in western Oklahoma and western Texas averaged 28 bushels per acre. In the boys' kafir club the highest yield was 90.8 bushels per acre, secured by Leland Shore, of Crescent, Logan County, Okla.

Grass and hay demonstrations.—Success has attended the grass demonstration campaign carried on in Virginia and the Carolinas during the last few years. The demonstration acreage in mixed grasses in Virginia alone increased from 15,000 acres in 1913 to 40,000 acres in 1914. Many of these demonstration farms gave a yield of 3½ tons to the acre.

Alfalfa.—There were about 4,000 acres in alfalfa demonstrations in Virginia during the 1913 season, and a great increase in alfalfa, especially in Tennessee, North Carolina, and South Carolina. Notwithstanding the exceedingly dry weather, the results were very satisfactory. In the majority of instances alfalfa on demonstration farms afforded four to six cuttings and yielded from 4½ to as high as 7 tons per acre.

LEGUMINOUS WINTER COVER CROPS.—The sowing of legumes as winter cover crops increased more than 300 per cent in the Southern States during the year. In South Carolina, for example, the last census showed less than 400 acres of clover in the State. More than 100,000 acres were sown in the fall of 1913 by demonstrators and cooperators alone, the principal crop being crimson clover and vetch. In Mississippi, Louisiana, Arkansas, and Tennessee, approximately 250,000 acres of lespedeza were sown as a result of the efforts of demonstration agents. A thousand 1-acre demonstrations in crimson clover in Alabama in 1912 resulted in the sowing of more than 100,000 acres of crimson clover in that State in the fall of 1913.

Bur clover demonstrations have been conducted for several years past in Arkansas, Louisiana, Mississippi, and Alabama. The interest aroused by these demonstrations was such that there was not half enough bur-clover seed in the country last year to supply the demand. A very active clover campaign has been carried on during the present year on every farm in the South, and as a result of this campaign it was confidently expected that the acreage to be seeded in the various clovers this fall will show a very large increase, notwithstanding the high price of seed incidental to the war in Europe.

LIVE STOCK.—During the year our demonstration agents have been instrumental, in cooperation with the Bureau of Animal Industry and the State institutions, in having brought into the South many thousand head of pure-bred live stock for breeding purposes, consisting chiefly of pure-bred hogs, dairy cattle, and beef breeds of cattle. Live-stock associations have been organized in practically every county in South Carolina and in a great number of counties in all the other States.

From reports of agents, a conservative estimate places the number of live stock for breeding purposes, including pure-bred males and pure-bred and grade females, that have been purchased through the direct influence of the demonstration work at 17,500 head, divided approximately as follows:

	Head.
Hogs	7,000
Dairy animals	5,000
Cattle of beef breeds	4,000
Horses	500
Sheep and goats	1,000

In a great many counties in the South cooperative associations have been organized for the purchase of pure-bred stallions and bulls.

During the year, demonstration agents have been active in helping farmers to combat the ravages of hog cholera, of which there have been numerous outbreaks in every Southern State. Thirty-four thousand two hundred and sixty-six head of hogs have been subjected by agents to the simple serum treatment and 7,713 to the simultaneous treatment. Of the total number of hogs treated, 14,450 were sick at the time of treatment. The total loss was only 3,004.

Two thousand five hundred silos have been erected through the efforts of demonstration agents.

BOYS' CLUB WORK.—The following statistics show the number of boys reporting in corn clubs in each State, the number making 100

bushels or more on their 1-acre plats, the average yield per acre of the boys reporting, and the yield per acre in each State in 1913:

Boys reporting in corn clubs, with yield of corn per acre.

State.	Number reporting.	Number making 100 bushels or more.	Average yield per acre of corn.	Yield per acre in State, 1913.	State	Number reporting.	Number making 100 bushels or more.	Average yield per acre of corn.	Yield per acre in State, 1913.
			Bush.	*Bush.*				*Bush.*	*Bush.*
Alabama	755	64	57.92	17	North Carolina	670	49	62.40	20
Arkansas	760	18	45.00	19	Oklahoma	866	1	48.00	11
Florida	246	5	46.25	15	South Carolina	489	20	59.75	20
Georgia	3,000	90	52.00	16	Tennessee	641	15	56.30	20
Kentucky	93	7	63.00	20	Texas	333	4	47.05	24
Louisiana	279	13	55.00	22	Virginia	775	71	68.50	26
Maryland	35	1	59.60	33	West Virginia	151	3	76.54	31
Mississippi	316	25	58.80	20					

It will be seen from this table that 386 boys made 100 bushels of corn or more on their acres.

Moisture-tight containers were sent by the Office of Grain Standardization to boys who it was thought would make 100 bushels or more to the acre. Two hundred and thirty-one samples were received and tested, showing an average moisture content of 15.5 per cent.

In addition to corn clubs, kafir and milo clubs have been organized in Texas and Oklahoma. These clubs enrolled 1,594 members in 1913. Cotton, peanut, and potato clubs have also been organized. Pig clubs, baby-beef clubs, poultry clubs, and clubs for boys and girls having for their object instruction in animal husbandry are being organized.

The influence of the training received in boys' corn clubs is frequently shown in the afterhistory of the boys. In one agricultural college alone there were 52 corn-club boys in 1913. Many girls also, becoming interested in canning, have taken the domestic-science course in the normal and industrial colleges.

GIRLS' CLUB WORK.—In the canning clubs of the Southern States there were 33,060 girls enrolled in 1913. The 4,202 girls who sent in reports put up 1,032,115 cans of tomatoes and 522,147 cans of other products, worth $180,420.05. Ten Mississippi girls made a profit of $868.66 from 10 tenth-acre gardens, at an average cost of $29.93. The best county record is that of Etowah County, Ala., where 104 girls put up more than 30,000 No. 3 cans of tomatoes, worth at least $3,600. Clyde Sullivan, of Ousley, Ga., had the best yield recorded in 1913. She produced 5,354 pounds of tomatoes from one-tenth of an acre, and canned 2,254 No. 2's and 212 No. 3's at a profit of $132.39. Margaret and May Belle Brown, of Mecklenburg County, N. C., on 2 tenth-acre plats, produced and sold vegetables to the value of $243.86, at a profit of $214.12.

This work trains girls to become efficient home makers, to develop the resources of the farm, to improve the quality of country life, and to become economically independent. The girls develop the special fruit and vegetable resources of their sections after they have studied tomatoes carefully for one year and have learned to grow and can them.

COOPERATION.—As heretofore, the work has been carried on in cooperation with States, agricultural colleges, schools, boards of trade, and private citizens. The extent of participation by such agencies increases each year. During the fiscal year the amount received from all such sources and expended directly for the salaries and travel of demonstration agents was approximately $500,000. About one-fourth of this sum was received from States and State institutions, the remainder from counties, boards of trade, or other local agencies. More than $100,000 additional was contributed by business men and institutions for prizes to winners of the boys' and girls' clubs of the various States. During the year cooperative relations have been entered into with practically every State agricultural college in the Southern States, by which all of the demonstration and extension work conducted by the department and by the college is merged under one management. Arrangements were practically completed or well under way before the end of the fiscal year in all but one of these States for the joint supervision of the extension work to be carried on by the agricultural colleges under the Lever bill, and by this and other offices of the United States Department of Agriculture under direct congressional appropriations.

BOTANICAL AND HORTICULTURAL WORK.

The work of the bureau relating to botanical and horticultural activities has been directed as follows: Mr. F. V. Coville was in charge of economic and systematic botany, Mr. D. G. Fairchild in charge of foreign seed and plant introduction, and Mr. A. V. Stubenrauch in charge of horticultural and pomological investigations; certain features of the plant-breeding work directed by Mr. W. T. Swingle were also included under this head, and Mr. E. M. Byrnes directed the work of gardens and grounds.

ECONOMIC HERBARIUM.—Additions to the economic herbarium have been carried forward as usual, amounting to 3,111 for the year. These include 100 new genera and 7 new families. Collections from Brazil and from China have been received from the Office of Foreign Seed and Plant Introduction, from which duplicates will be distributed as soon as determinations are completed.

APPLE STORAGE WORK.—The results of the apple storage work in the Pacific Northwest show that the most important factors in successful apple storage are (*a*) sound, healthy fruit, well grown and well developed; (*b*) proper maturity at time of packing; (*c*) care in all handling operations; (*d*) prompt storage; (*e*) a constant temperature, 31° to 32° F. appearing to be the optimum. The fact stands out rather prominently that when harvesting is delayed until a more advanced state of maturity is reached than is generally allowed, apples keep in storage in a decidedly better condition than they do with the degree of maturity at which they are usually picked in the Northwest.

BARTLETT-PEAR STORAGE.—The results of the Bartlett-pear storage investigations in the Rogue River Valley indicate that Bartlett pears when picked at the proper time, which appears to be fully two weeks later than the usual date of beginning the commercial

pickings in the Rogue River Valley, can be stored safely even beyond the four-week limit which was fixed as the period of these investigations.

California grape storage.—The California grape storage work the past season has directed attention to the probable value for commercial purposes of some of the new and little-known varieties that are under test in the Fresno and Oakville (Cal.) experimental vineyards. An outgrowth of the study of methods of packing is the establishment of a commercial industry in the shipment to eastern markets of the Emperor variety packed in redwood sawdust.

Florida orange handling.—Investigations in the handling of oranges in Florida have so emphasized the absolute necessity of careful handling and have so conclusively shown that loss from decay can be almost entirely eliminated by proper methods of handling that the methods of commercial practice have been very largely modified to conform thereto. An investigation of the value of precooling the fruit before shipping showed that while there was comparatively little decay in experimental lots of fruit shipped in the ordinary way, the percentage was approximately three times as high on arrival at destination as it was when similar lots were precooled before shipping.

Fresh-fig transportation.—The transportation of fresh figs from California to the eastern markets has progressed far enough to establish the practicability of transporting the fruit in pony refrigerators when the individual fruits are placed in soft paper wrappers and packed in a fine grade of excelsior. The economic limitations of this practice have not been sufficiently determined to justify a further statement at this time.

Pineapple transportation.—The season's work in handling pineapples from Florida indicates that it is practicable to delay harvesting until the fruit is in a hard-ripe condition, at which time the flavor is well developed. If this is adopted as a commercial practice it will result in placing fruits of very much higher quality upon the markets.

Lettuce.—The handling and precooling work with lettuce grown in Florida during the last season indicates that by improvement in methods of handling, modification of the type of container, and quick cooling of the product after harvest, lettuce can be delivered on the northern markets so as to stand up much longer than it does under commercial practices.

Viticulture.—The grape work in Vinifera regions is conducted largely through the 11 experimental vineyards which are located in a corresponding number of representative grape-growing districts in California. These vineyards have now reached such an age that each season's results are of increasing value to the grape industry. The more important problems being worked out in these vineyards are resistance to phylloxera, congeniality of different stocks to different varieties, productiveness, saccharine and acid content of the different sorts grown under different conditions, and the adaptability of different varieties to different conditions. The collection of

varieties under trial is very comprehensive in its scope and includes a number of promising sorts which were nearly extinct.

Through the results obtained in the experimental vineyard of American native varieties at Vineland, N. J., in a location which was at one time an important grape-producing section, the industry has to a marked extent improved its methods and enlarged its production of grapes.

Nut culture.—Two promising new varieties of pecans have come to light during the year—one, the Bidwell, from northern California; the other, the Norton, from eastern Missouri. These are the first varieties from these States to attract attention and to receive names.

Fruit breeding.—As a result of the work of bud selection of citrus trees in California, it is rapidly becoming a matter of orchard practice in that State to work over unprofitable individual trees with buds from those that consistently produce the desired type of fruit in abundance. A beginning has been made in the study of bud variation of apples and peaches in some of the representative producing sections.

Fruit identification.—During the year the total receipts of fruit for examination, identification, and other purposes numbered about 8,775 entries. Of this number nearly 4,000 entries were sent by persons who wished the fruit identified. In addition to this phase of the work, about 180 technical descriptions of varieties have been added to the files, more than 250 water-color paintings of fruit have been made, and about 80 wax models of fruits have been prepared.

Irish potatoes.—The selection and breeding work with Irish potatoes has demonstrated the advantage to be gained by the industry from the use of carefully selected seed. The breeding work has already developed a number of hybrid varieties which in type of tuber, vigor of plant, and season of maturity show special promise for both the trucking regions of the Atlantic coast, as well as varieties for the standard commercial potato sections of the North. Work has been under way during the year in Maine, New York, Idaho, and California.

Denia onion seed.—Denia onion seed which compares favorably with that imported from Teneriffe has been produced in quantity sufficient to demonstrate its quality, but the commercial production of the seed is not yet satisfactorily worked out.

The dasheen.—In order to determine whether the methods of taro culture in Hawaii could be adapted to the cultivation of a related root crop, the dasheen, in our wet rice lands, Mr. R. A. Young spent several weeks in the taro patches of the Hawaiian Islands making a thorough investigation, which will be utilized in the working out of the dasheen problem in the South.

Blueberry culture.—In the progress of the cooperative experiments on field plantings of blueberries it has been shown that for hybrids and other potted plants the best season for transplanting is not spring but early autumn, when the plants are still in full leaf and when the excessive heat of summer is over. It is a strange charac-

teristic of the blueberry that the plants make no new root growth in the spring until the flowering is past and the new twig growth has been completed. Severe hot spells in late spring, therefore, sometimes cause great injury to plants that have been recently set out. This cause of injury is eliminated by fall planting.

Fig culture.—Investigations conducted during the year have confirmed the previous estimates of the value of the Abyssinian fig (*Ficus pseudocarica*) for use in caprifying the early (breba) crop of figs.

The winter-generation Smyrna caprifigs contain numerous fig insects (Blastophaga), but no pollen-bearing flowers. In consequence, these caprifigs are of no value for caprifying the breba crop of Smyrna and other figs. The Abyssinian caprifigs of the winter generation carry both fig insects and pollen and consequently can be used for caprifying the breba crop.

Date culture.—Nearly 20,000 date offshoots were imported from the Old World oases by private growers in the Imperial and Coachella Valleys of California during the year, and the growing of dates is rapidly becoming one of the most promising fruit industries in this region. Many of the palms from earlier importations are now bearing fruit.

Custard-apples.—In connection with the work on the custard-apples and their allies two important papers have been published. These papers are preliminary to a monograph of the genus Anona, with special reference to the economic species of commercial importance.

A hard-shelled avocado from Guatemala.—An expedition has been made to the plateau regions of Guatemala to obtain superior varieties of avocados, adapted to the needs of commercial production in the United States. In hardiness and other important respects these Central American varieties are greatly superior to those that came to Florida from the West Indies. Instead of a soft, flexible skin, the Central American avocados are covered with firm, hard shells.

Jujube.—The Chinese Ziziphus, or jujube, a peculiarly drought-resistant fruit tree, is proving to be a promising introduction. Especially large-fruited forms of superior quality have been introduced from China.

Kumquat.—The Australian desert kumquat, the hardiest evergreen citrus fruit, has recently been introduced. This plant yields an acid, edible fruit, excellent for making ade. In spite of its promising nature for use in hybridizing, it has been hitherto completely ignored by plant breeders because of a mistaken idea as to its relationships.

Another interesting group embraces the African cherry oranges (*Citropsis* spp.), brought to light in central Africa. These yield small, highly colored fruits, borne in clusters like cherries, said to be aromatic and of delicious flavor.

Citrandarin.—During the year a "citrandarin," obtained by crossing the Oneco tangerine and the trifoliate orange, ripened for the first time and yielded a fruit so sweet and of such good quality that it seems probable that it may prove to be a table fruit, to be eaten like

an orange. This is the first trifoliate hybrid that has produced fruit sweet enough to be promising as a table fruit. Judging from its parentage and also from its actual behavior during the last three winters, it is likely to prove nearly as hardy as the citrange and other trifoliate hybrids.

CHINESE WOOD-OIL TREES.—A sufficient number of Chinese wood-oil trees to plant 400 acres were distributed in the vicinity of Tallahassee, Fla., where trees planted in 1907 have yielded well and remained healthy, warranting the belief that this tree may become a valuable secondary tree crop for the extreme South.

CHINESE CHESTNUTS.—Three hundred pounds of seed of a Chinese species of chestnut possessing a high degree of resistance to the bark disease now working such destruction in the eastern United States have been secured.

PLANT INTRODUCTION.—With the closure of the mails by the plant-quarantine act against all countries having no adequate inspection service, the plant-introduction office has become the main avenue through which all new foreign plants come into the country, and the providing of facilities for handling this stream of new plants in such a way that no parasitic insects or fungous parasites shall get in with the plants has required special attention during the year. These facilities will still require very great modification and enlargement to meet the demands of the quarantine regulations.

BRAZILIAN ORANGES.—An expedition composed of Messrs. P. H. Dorsett, A. D. Shamel, and Wilson Popenoe visited the southeastern provinces of Brazil to make a careful study of the Bahia orange industry. The great navel-orange industry of California dates from the introduction by the United States Department of Agriculture of a few navel orange trees from Bahia, Brazil, in 1870, since which time no study has been made of this variety in the region of its origin. With the discovery in the California orchards of the great variability of this navel variety, the question arose as to whether that importation might not have consisted of a more variable strain than others to be found in Bahia. The expedition determined by careful plat examination carried out in Bahian orchards that the variety is quite as variable there as here and secured valuable scion material for testing under California conditions.

CHINESE WILD PEACH.—Much interest has been awakened on account of the success of various experiments in the use of the Chinese wild peach (*Amygdalus davidiana*) as a stock for plums, prunes, apricots, peaches, and almonds. Between 10,000 and 15,000 young trees of this stock will be distributed this season.

MIAMI FIELD STATION.—The overcrowded condition of the Miami field station, the growing importance of the citrus work, and the large number of subtropical introductions received made it necessary to have additional space. A tract of land containing 25 acres near Buena Vista has been secured through Mr. Charles Deering for a new location for the work, which for a number of years has been conducted at Miami.

GARDENS AND GROUNDS.—The superstructure of a greenhouse 50 feet long, 30 feet high, and 20 feet wide, which was destroyed in a wind-

storm in August, 1913, was rebuilt immediately. An addition, 32 feet long, 20 feet wide, and 14 feet high, to a greenhouse used for physical and physiological investigations of plants has been constructed.

CONGRESSIONAL SEED DISTRIBUTION.

The congressional seed distribution has been continued as in the past, Mr. R. A. Oakley having succeeded Mr. L. M. Estabrook in charge of this work.

Congressional seed distribution.—During the fiscal year 1914 there were distributed on congressional and miscellaneous requests 11,221,578 packages of vegetable seed, and 2,904,188 packages of flower seed, or a total of 14,125,766 packages, each containing five packets of different varieties.

There were also distributed 30,135 packages of improved cotton seed, 15,705 packages of lawn grass, including Bermuda grass, 13,534 boxes of imported narcissus and tulip bulbs, 8,890 grapevines, comprising 13 varieties, 95,055 strawberry plants, comprising 16 varieties, and limited quantities of alfalfa, clover, vetch, cowpeas, and soy beans. The seed was purchased on competitive bids, as heretofore, and each lot was thoroughly tested for purity and viability before acceptance by the department. Approximately 75 per cent of this seed was secured from surplus stocks, the remainder being grown under contract especially for the department.

The contract of last year for packeting, assembling, and mailing vegetable and flower seed was continued in effect, the price being 94½ cents per 1,000 packets, which included hauling to the city post office or to the mail cars on the track.

Provision was made in the appropriation for the fiscal year 1914 similar to that for 1913 for the purchase and distribution of drought-resistant field seeds. This distribution was conducted in sections where dry-land farming is practiced. Only new crops or improved strains of standard crops were distributed, the most important ones being alfalfa, broom corn, feterita, kafir, milo, millet, sumac, Freed and Amber sorghum, Sudan grass, sweet clover, corn, wheat, and field peas.

Sudan grass, a new wild sorghum recently introduced from Africa by the department, which was first distributed in 1913, proved so valuable under the extremely dry conditions of last season that it was very much in demand this year. The Grimm and other hardy and drought-resistant alfalfas were likewise very popular. Approximately 91,000 packages of seed were distributed, and in the majority of cases each package contained enough seed to plant 1 acre. Results so far have been very gratifying.

REPORT OF THE FORESTER.

UNITED STATES DEPARTMENT OF AGRICULTURE,
FOREST SERVICE,
Washington, D. C., September 23, 1914.

SIR: I have the honor to transmit herewith a report of the work of the Forest Service for the fiscal year ended June 30, 1914.

Respectfully,

HENRY S. GRAVES, *Forester.*

Hon. D. F. HOUSTON,
Secretary of Agriculture.

THE NATIONAL FORESTS.

Presidential proclamations and Executive orders excluded from the National Forests last year 1,565,141 acres of land, and added 269,695 acres. The result was to leave within the National Forest boundaries on June 30, 1914, 185,321,202 acres, including 21,472,678 acres of alienated land.

COST AND RECEIPTS.

The following table shows the receipts from the National Forests in 1914, compared with 1913:

Comparison of receipts from the several sources for the fiscal years 1914 and 1913.

Fiscal year.	Timber.	Grazing.	Special uses.	All sources.
1914	$1,304,053.56	$1,002,347.59	$131,309.06	$2,437,710.21
1913	1,275,556.48	999,369.16	116,995.21	2,391,920.85

Final figures regarding the expenditures of the fiscal year are not available at the time that this report is made, but the gross cost involved in National Forest administration and protection was approximately $4,750,000, while the expenditures for improvements on the Forests, including road building for the benefit of the public, were approximately $620,000. The first-named sum includes both overhead costs and the outlay for such lines of work as land classification, survey of Forest homesteads for settlers, and investigations conducted on the Forests to secure better knowledge of their timber, forage, and water resources and of the methods which will promote their fullest use.

CLAIMS AND ALIENATIONS.

During the year 1,321 individual tracts of land passed into private ownership through the patenting of claims. Of these, 732 were homestead, 3 desert land, 67 timber and stone, 513 mineral, 3 coal, and 3 miscellaneous claims. Since National Forests are not subject to entry under the desert land and timber and stone laws, all claims of these classes were initiated prior to the creation of the Forests within which they lie. The homestead claims were initiated partly before the Forests were created and partly under the Forest homestead law of 1906.

The mineral entries and coal entries also were initiated partly before and partly after the Forests were established, since mining and prospecting and the patenting of mineral and coal lands are permitted and encouraged.

While administration of the National Forests from the standpoint of national interests involves no hindrance to development under private ownership of their agricultural and mineral resources, or to the patenting of claims taken up in good faith for these purposes, in conformity with existing law, it is still necessary to guard this public property against private acquisition through misuse of the public land laws for the sake of the timber involved. Efforts to get public timber land fraudulently did not cease when the National Forests were established. The actual stealing of timber, the use of dummy entrymen, and other crude methods of fraud were quickly stopped, but subtler and more refined methods are persistently continued and are a constant menace to the integrity of the Forests. Timber frauds undertaken on the National Forests are mainly through clever manipulation and abuse of the homestead and mineral land laws by a class of persons quite distinct from the bona fide homeseeker and prospector.

Very commonly the fraudulent timber-homestead is an old squatter location. During the feverish speculation in Government timber just prior to the creation of many of the National Forests thousands of locations were made in the best timber by professional locators and others. A small cabin was built on each claim, often by the locator or his hired assistant. These cabins were small log or shake affairs, never designed to live in, but constructed solely to hold the claim. Such cabins may remain unoccupied and the land totally undeveloped for many years. When the public-land survey is made a rush takes place to assert rights to these old locations under the allegation that the cabins have been the "residences" and the only "homes" of the claimants since prior to the establishment of the National Forests. The claimants then begin to spend time on the claims during the pleasant summer months, to improve the cabins or to construct new buildings, to cultivate small gardens, to slash down some of the trees (usually leaving the most valuable standing) on an acre or so near the cabin, to sow timothy over the openings thus made, and otherwise to go through motions of agricultural activities. There are hundreds of such claims situated in the inaccessible and most rugged portions of the mountains, on lands so steep and rough that agriculture will never be possible, but which carry heavy timber of great value. Many of them contain from two to twenty million feet of timber and are worth from five to twenty thousand dollars each.

One group of five claims, now being protested by the Forest Service, situated in Idaho 45 miles from the nearest railroad point and located on steep canyon slopes having a grade of 15 to 90 per cent, is worth by actual appraisal $94,000. There is no agricultural land. The claimants never have made a pretense of occupying the cabins except on summer trips, and made no effort to clear and cultivate until, five or six years after the Forest was established, the survey was made. Now they are trying to build up their equities and are claiming rights to this timber prize under the homestead laws. Scores of similar instances are in the records of the Forest Service. In the heavily timbered districts of the Northwest alone fraudulent timber claims asserted under the homestead law which carry 391,318,000 feet of timber, worth not less than $700,000, are now under protest by the Forest Service. Of the 12,330 acres comprised in these claims, the total area actually cultivated by the claimants at the time of the protest to the General Land Office and request by the Forest Service that they be canceled was 47 acres, or less than four-tenths of 1 per cent. In contrast with this is the showing from one of the districts on entries made under the Forest homestead act on lands classified as agricultural by the department and opened to entry at its request. A recent examination of 104 entries by the surveyors who surveyed them disclosed that the average amount cultivated per claim was 22.1 acres, or over 20 per cent of the land entered. This had been accomplished before the time had been reached at which under the law the claimants could prove up on the land.

The problem extends far beyond the claims now under contest. There are hundreds of old abandoned locations, with their little cabins on unsurveyed land, to which claim will be asserted just as soon as the land is surveyed. Locations of this kind are actually known to the Forest Service which involve between three and four million dollars' worth of timber; and there are many more.

There are also attempts to secure fraudulently heavy timber through the misuse of the mining laws. The bona fide miner and prospector does not attempt to abuse the mining laws, and every opportunity is given him to work in the National Forests just as on the public domain outside. But still there are men who are endeavoring to use the mining laws as a cloak to cover timber frauds, and who are endeavoring to secure land chiefly valuable for the timber, or for other purposes, though no real discovery has been made, and the alleged mining activities on the ground are a mere pretense. Such claims are protested by the Forest Service.

The heavily timbered claim in nearly every case finally finds its way into the hands of the lumber company or the timber speculator. This has been proved by the history of the claims which have been patented. Figures were obtained on nine townships in Idaho immediately adjacent to the St. Joe National Forest. Of 264 homesteads patented, 208 passed to lumber companies within from one to three years after patent was issued, and nearly all the rest are being held for timber speculation. The claimants, except in a few instances where exceptional conditions exist, are not occupying the land and developing it for agriculture, for the simple reason that, while it is of great value for timber, it is not suited to agriculture. The lumber companies which have bought most of the land belong to the group which already controls enormous quantities of stumpage.

Another test was made in a township in the Coeur d'Alene and St. Joe National Forests. One hundred patented homesteads were selected at random, regardless of the character of the land or timber. Although in many cases patent had only recently issued, 70 per cent of the homesteads had passed to lumber companies. The history of the Olympic Peninsula in Washington illustrates the same process. Of the surveyed lands north of township 17 taken up under the homestead law, 95 per cent have passed into the hands of timber companies and timber holders and speculators. In a township in Idaho which contains some of the finest white pine in the country, of 58 homesteads based on locations made in 1900, 1901, and 1902 by the usual methods of the professional locator, all but 11 had by 1912 passed to the lumber companies.

These facts show that the private acquisition of timberlands does not lead to agricultural development. On the contrary, if any of the land is agricultural in character, such development is retarded, for the lumber company which gets it holds the land until it wants to cut the timber and afterwards demands a high price for the land. Private acquisition of these lands means a loss to the public by the giving away of property of high value, by retarding rather than stimulating agriculture on land suited to that purpose, by adding to the holdings and control of already rich and strong timber companies, by weakening the hand of the Government through the acquisition by strong companies of strategically located tracts within Government timber, by making more difficult fire protection and administration of the public property, and by turning over to private owners lands which the Government should own for adequate protection of watersheds, and which ultimately may have to be bought back.

The Forest Service is doing what it can to stop such fraud.

LAND CLASSIFICATION.

Systematic land classification work is now under way on 100 of the National Forests. The Forest homestead law, passed June 11, 1906, provided that lands in the Forests may be examined, upon application or otherwise, and, if found chiefly valuable for agriculture, listed for homestead entry. It provided also that when the examination is made at the request of an applicant, the latter shall have a 60 days' preference right to file on the land if it is classified and listed as agricultural. This law made possible agricultural development of scattered bodies of land within the Forests which could not advantageously be dealt with through eliminations. Action on lands which could be so dealt with has always been possible, and has been steadily taking place, through readjustment of the Forest boundaries by presidential proclamation. Land classification to provide for the needs of settlers, therefore, comprises (1) determination of areas to be dealt with through elimination, (2) classification of listable lands not applied for by individuals, and (3) classification of single tracts on the request of applicants.

Until two years ago the work was almost entirely confined to that under the first and third heads. It was obviously important, first of all, to deal with the lands along the border of the Forests, where

relatively large areas could be rapidly examined and the settlement demand was greatest. Especially was this true in view of the fact that the funds available to carry on the work were far below the need. At the same time, the work of making examination of specific tracts desired by prospective settlers had to be carried on and kept current to avoid hardship for those who wished to know whether or not they might go on the land expecting to get title.

In consequence of the systematic and thoroughgoing classification work of the lands along all the National Forest boundaries begun in 1909, a total of over 10,000,000 acres has to date been eliminated from the Forests through boundary readjustments. The eliminations of the last fiscal year comprised 144,420 acres from the Jemez National Forest, 160 acres from the Rio Grande, 346,940 from the Nebraska, 175,605 from the Carson, 40,850 from the La Sal, 350,240 from the Paulina, 59,306 from the Deschutes, 23,700 from the Rainier, 3,870 from the Cleveland, 15,090 from the Arkansas, 38,300 from the Toiyabe, 32,740 from the Siskiyou, 680 from the Challis, and 333,240 from the Santa Barbara. Final action was taken looking to the elimination of 10,240 acres from the Umpqua National Forest, the formal proclamation being signed a few days after the close of the fiscal year. During the fiscal year action was taken which will result in the elimination of 497,540 acres from the Kern National Forest, 161,920 acres from the Sequoia, and 77,400 acres from the Sierra.

The results of the year in classifying individual tracts applied for were the listing of 2,690 such tracts, totaling 282,483 acres of land, while 1,033 tracts were classified as nonlistable. The total number of tracts listed for the benefit of applicants since the Forest homestead law was passed was, on June 30, 1914, 15,521, with a total of 1,684,069 acres thus opened to settlement.

The procedure under which applications are made has been somewhat modified to correct certain disadvantages both to the applicant and to the Forest Service which were found to arise. In applying the Forest homestead act, the attempt was made to facilitate application by avoiding all routine formalities. While a simple form of application blank was provided for the convenience of those wishing to use it, examinations were sometimes made merely upon letter application or even postal-card request. Advantage was taken of this informal procedure by unscrupulous land sharpers and real estate agencies in some of the larger western cities. It was represented to land seekers unfamiliar with the facts that the National Forests contained vast bodies of desirable agricultural land, which would be examined and opened to entry upon application. These locators assured the would-be homesteader that in consideration of a fee, ranging from $5 to $100, paid by him to the real estate agent in advance, the latter would secure for the land seeker the right to have 160 acres of land in the National Forest examined, which land, if found chiefly valuable for agriculture, would be opened to entry, and the applicant would have a 60-day period in which to file in advance of some one else. A great many people were defrauded in this way. Sometimes the land described in the application was located where it might have some agricultural value. Just as often it was located on a rocky mountain side, impossible of cultivation or even permanent occupancy. This sort of thing made endless work for the

Forest Service by requiring the examination of land not agricultural in character, which the applicant would neither want nor take if he had ever seen it. On the other hand, this system deprived the home seeker of his money and caused bitterness and disappointment on his part, which the operator in self-defense naturally deflected against the Forest Service. It was easy to assert that the land applied for was fine agricultural land, and that the Forest officer who made the examination was either prejudiced or incompetent.

Recently a new form of application blank has been adopted and regulations promulgated for the purpose of cutting out the swindling locator. The new system is simplicity itself. It merely requires that the applicant shall go before a Forest officer and certify that he has actually been upon the land described and believes it to be agricultural in character. This brings the applicant in contact with an officer of the Forest Service who is able to describe to him the approximate character of the land applied for and tell him definitely his rights under the law. This, together with the fact that the applicant must actually visit the land, will prevent widespread fraud and misunderstandings such as have existed in the past. The new procedure has now been in effect a sufficient length of time to demonstrate that it works admirably and is proving advantageous both to the applicant and to the Forest Service.

It has already been said that systematic land classification to discover in advance of application lands to be opened to settlement through listing began only two years ago. Its inauguration was provided for by a special item in the appropriation act for 1913. The amount thus made available was $35,000; for 1914 the appropriation was increased to $65,000, with $35,000 more for surveying Forest homestead claims. The increased appropriation is making it possible to meet the demands with increased promptness and to cover questionable areas with a thoroughness previously impossible. While the acreage of desirable farm land remaining in the Forests has been reduced to only a fraction of its former area, it is passing into the hands of settlers more rapidly than ever before.

Within another year classification of the areas which are clearly most valuable for farm purposes and which will, if listed, undergo agricultural development and not be held for speculation in timber values will have been carried to an advanced point. Every considerable area of National Forest land known to have possible agricultural value is now being examined. There will nevertheless remain after the completion of these projects many difficult problems to solve and a good deal of scattered land which must be searched out painstakingly and slowly for some years. There will also be land which, because of the presence of heavy and valuable stands of timber, it will be necessary to classify as chiefly valuable for the timber, though after the timber has been cut and removed the land should be listed. Where such land is found the Forest Service will seek to make timber sales that will make the land available for settlement at as early a time as is practicable. Experience has repeatedly demonstrated that to list such land before the removal of the timber retards rather than hastens agricultural development, for the reason that the original entrymen sell to large lumber companies, which retain the land for speculative purposes. This has been so clearly shown that some western communities have petitioned the

Forest Service not to open such land to homestead entry until after the timber is cut or removed, upon the ground that what the country needed was not more opportunities for timber speculation, but more home building and actual agricultural development.

Similar considerations sometimes require to be weighed under another class of conditions. One of the classification projects, embracing a gross area of some 50,000 acres, includes 14,480 acres of land which has already been patented—practically all before the creation of the Forest—some under the homestead law, but more under the timber and stone law. Only 8 acres of this patented land is being farmed, or slightly over 1 acre out of every 2,000; all the rest is used solely for grazing purposes. One stock outfit alone owns and leases over 6,000 acres, while four outfits have considerably more than half of all the land that has been patented. Several individual tracts within this area have already been listed upon individual applications, and much more has been applied for. Of the listed land only one tract has been patented. The patentee secured title in September, 1913. Before April, 1914, the land had passed into the possession of one of the large stock outfits. Under National Forest administration the land is put to grazing use and is subject to the established system of regulation. The facts seem to point to the conclusion that under present conditions the land is more valuable for grazing than for agriculture and that the only result of listing it would be a different distribution of the present grazing privilege, not a different use of the land. As National Forest land the full forage crop of this area can be utilized along with protection of the thrifty young forest growth which is restocking much of the land. If changing economic conditions bring it about later on that the land becomes chiefly valuable for agriculture, postponement of listing until that time will make it easily obtainable by the home builder instead of placing it in the hands of stockmen, who, if they admit the home builder at all, will do so on terms as favorable as possible to themselves. The listing policy should not be made the means for increasing the incubus of land speculation, which already withholds from development so much of the western country.

FOREST MANAGEMENT.

Timber sales on the National Forests supply demands from two sources. The first is local use by railroads, mines, and communities in the vicinity of the National Forests. This demand requires from 30 to 40 per cent of the annual cut. It is comparatively stable. The second demand is from the general lumber market.

The amount of timber cut and the receipts from sales thus depend in large part upon trade conditions in the lumbering industry. A consistent effort has been made by the Forest Service to make the annual volume of business more stable both by increasing local sales and by encouraging sales for varied industries, such as the manufacture of pulp and paper and of wood distillates, whose demands are less affected by trade conditions. While substantial progress has been made in this direction, no large increase in the volume of timber sales is possible except in connection with good business conditions in the lumber trade of the United States.

Last year was for the greater part one of weak lumber markets and curtailed production. Lumber manufacture was active and trade con-

ditions good from August, 1912, to May, 1913. This period of good times in the industry was reflected in the large timber-sale business reported for the fiscal year 1913. Since then, however, the demand for lumber has fallen off to a marked degree. Many of the mills operating in National Forest regions, including purchasers from the Forests, have been forced to carry excessive stocks, particularly of low grades. There has been a drop in lumber prices of from $1 to $4 per thousand feet on various grades. Possible purchasers, including a number who had previously applied for blocks of National Forest stumpage, became very cautious. While the cut under outstanding sale contracts has been well sustained and exceeds that of the preceding year by 131,000,000 board feet, new sales for the general lumber market have fallen off materially.

It is the aim of the Forest Service to increase the cut of timber from the National Forests as rapidly as practicable, subject to securing the market value of the stumpage. Well-directed cuttings are highly desirable, both to utilize mature stumpage and to improve the condition of the Forests. It is axiomatic that National Forest timber must be administered, as far as it can influence the lumber market, so as to maintain competitive conditions in the industry and check attempts at monopoly. Local needs and industries must always be fully supplied. At the same time it must be borne in mind that extensive cutting for the general markets of the country, when lumber production is already excessive and competition as keen as it could be, can not produce lower lumber prices, but may encourage wasteful utilization of standing timber, which results from an overstocked market and the inability of operators to sell readily any but the better grades of lumber. There must also be considered the interest of local communities in obtaining local revenues from their share of National Forest receipts, and of the Government in obtaining a return to counterbalance the necessary cost of efficient administration and protection.

It is obvious that no sound timber-sale policy is possible without a thorough understanding of the factors controlling the production and marketing of lumber in the United States. A study designed to furnish such an understanding has been initiated in cooperation with the Bureau of Corporations and the Bureau of Foreign and Domestic Commerce in the Department of Commerce. Briefly, this inquiry seeks to ascertain to what extent there may be an overproduction of forest products, what are its causes, and how it is affecting the utilization of raw materials produced in the forest. The inquiry is designed also to bring out the more essential facts concerning the distribution and marketing of lumber, whose bearing upon timber supply as a broad economic question is important. How far the present situation may be for or against the permanent interests of the public is the principal question which this study seeks to answer.

TIMBER SALES BUSINESS OF THE YEAR.

The cut of timber under outstanding sales shows a substantial increase. In 1914 the cut under sales totaled 626,000,000 board feet as compared with 495,000,000 feet in 1913, an increase of 26 per cent. The value of the timber cut was $1,271,000 as compared with $1,075,000 in the former year. Applications for new sales for the

general lumber trade were, however, much fewer in number. The total amount of timber sold during the year was 1,540,000,000 board feet, a decrease of 28 per cent from 1913, but nearly double the quantity sold in 1912 and sufficient to insure a continued increase in the amount and value of the annual cut.

Every effort consistent with sound management was made to increase the volume of sales. Desirable blocks were appraised, placed upon the market, and widely advertised. The terms offered have been as liberal as proper regard for the public interests would permit. Sacrifices in price below the market value of the stumpage, as appraised by competent logging engineers, have, however, not been considered. Such action would be contrary to law, to say nothing of sound business policy. As a matter of fact, the reason why more sales could not be made does not lie in the price asked, but in the difficulty of disposing of inaccessible blocks of timber at any price. Large investments are necessary to develop nearly all extensive areas of National Forest stumpage. Many pending applications, under which an entire agreement on the terms of sale was reached, were withdrawn because of the inability of the applicant to secure the capital required.

There has been a marked increase in small sales. The total number of sales during 1914 was 8,298 as compared with 6,182 in the preceding year. This indicates more general use of the National Forests for the supply of local needs and an increase in the kind of sales business which the Forest Service has always been most anxious to develop.

The quantities of timber cut and sold, by States, and their respective values are set forth in the following table:

Timber sold and cut under commercial sales on the National Forests.

State.	Timber sold.		Timber cut under sales.	
	Quantity.	Value.	Quantity.	Value.
	Board feet.		*Board feet.*	
Arizona	48,598,000	$100,843.21	58,095,000	$140,791.97
Arkansas	25,984,000	93,049.01	14,049,000	38,414.51
California	79,706,000	153,171.54	48,598,000	105,467.99
Colorado	45,665,000	89,172.97	46,561,000	92,564.02
Florida	30,000	17.00	10,000	5.00
Georgia	5,000	3.00		
Idaho	323,218,000	932,494.17	89,686,000	169,249.02
Michigan	94,000	385.40	27,000	58.20
Minnesota	348,000	1,729.04	348,000	1,729.04
Montana	247,787,000	521,981.26	117,696,000	247,858.53
Nevada	2,743,000	7,971.08	3,097,000	9,588.40
New Mexico	146,179,000	311,322.23	21,739,000	51,959.14
North Carolina	833,000	370.20	283,000	163.75
Oregon	25,734,000	49,355.71	74,172,000	160,064.30
South Dakota	166,868,000	473,169.81	12,725,000	32,333.60
Utah	28,100,000	74,675.52	12,837,000	29,992.34
Virginia	846,000	758.53	489,000	499.60
Washington	199,146,000	303,735.10	59,431,000	102,510.61
Wyoming	139,009,000	364,965.85	11,757,000	24,501.04
Alaska	44,984,000	56,788.53	45,061,000	56,779.12
Total, 1914	1,525,877,000	3,535,959.16	616,661,000	1,264,530.18
Total, 1913	2,137,311,000	4,465,958.85	495,668,000	1,075,184.96
Total commercial sales, 1914	1,525,877,000	3,535,959.16	616,661,000	1,264,530.18
Total sales at cost, 1914	14,207,000	10,035.38	9,645,000	6,569.98
Grand total, 1914	1,540,084,000	3,545,994.54	626,306,000	1,271,100.16

The average stumpage price obtained in commercial sales was $2.32 per thousand board feet, an increase of 22 cents over that of the preceding fiscal year. The increase is due to the inclusion of several large sales of white pine timber in northern Idaho, which commands exceptionally high stumpage prices.

On the Florida National Forest the timber now yields its chief revenue through turpentining operations, which brought in $15,372.16.

As during the preceding year, the bulk of the timber sold was under relatively large contracts for inaccessible areas, whose product will be marketed in the principal consuming regions of the United States. Under one sale of 125 million feet, however, on the Bonneville National Forest, in Wyoming, ties will be cut almost exclusively for the local supply of a large western railroad. Several smaller sales of tie timber were also made. A sale of 34 million feet on the Tongass National Forest will supply almost exclusively local industries and communities in Alaska. The cut under a sale of 153 million feet of western yellow pine in the Black Hills and Harney National Forests will be consumed largely in western South Dakota and Nebraska. All told, the total of sales for local use exceeds by a considerable margin the business of this character transacted during any preceding year.

The more important of the large sales whose cut will contribute to the general lumber needs of the country are four contracts in the white-pine belt of western Montana and northern Idaho. These aggregate 408,000,000 board feet of saw timber and upward of 200,000 red cedar poles. Cutting under these contracts will clear approximately 24,000 acres of agricultural land, which will be made available for settlement as fast as the timber is removed. Two contracts for a total of 126,740,000 feet of saw timber on the Olympic National Forest, in western Washington, mark the opening up of this vast Forest, which contains 33 billion feet of stumpage. Its timber has hitherto been so inaccessible as to preclude sales. A sale of 130,000,000 feet, principally western yellow pine, was also made on the Wallowa National Forest, in eastern Oregon, which will result in releasing several thousand acres of agricultural land for settlement. A sale of 43,000 cords of western red-cedar shingle bolts was made on the Washington National Forest, and a further contract for 117,000,000 feet, chiefly western yellow pine, on the Carson National Forest, in New Mexico.

In addition to these contracts the sale of seven large areas was approved during the year, following an estimate and appraisal of their stumpage. The most important of these is a body of 1,000,000,000 feet of western yellow pine on the Kaibab National Forest, in northern Arizona, adjoining the northern rim of the Grand Canyon of the Colorado River. The exploitation of this area will require the construction of approximately 200 miles of railroad unless further developments in trunk-line construction in this region bring the Forest nearer to rail facilities. While the immediate sale of this timber is not probable, it is desirable for the Government definitely to place such bodies of mature stumpage on the market. The timber in this instance will be an important part of the traffic necessary to support a railroad, and by thus assuring its availability for purchase the resources of the National Forests are made the means of stimulating local development. For the same reason, the

sale of three large areas on the watershed of Klamath River, in northwestern California, aggregating a little over 2,000,000,000 feet, was also approved.

That small sales still form the greater number of transactions, indicating the extent to which National Forest timber is drawn upon for local use, is shown by the following table. As compared with the preceding fiscal year, there has been an increase of 17 per cent in the number of sales involving $500 worth of timber or less.

Number of timber sales, fiscal year 1914, classified according to amount of sale.

[Includes sales at cost to settlers and farmers.]

State.	Under $100.	$101 to $500.	$501 to $1,000.	$1,001 to $5,000.	Over $5,000.	Total number of sales.	Sales at cost.
							Number.
Arizona	477	5	2	1	3	488	13
Arkansas	39	2	3	3	8	55	17
California	682	16	11	10	4	723	135
Colorado	851	20	10	12	4	897	200
Florida	5					5	
Georgia	1					1	
Idaho	1,206	18	5	13	5	1,247	627
Michigan		1				1	
Minnesota	5	3	1			9	2
Montana	1,764	30	5	24	9	1,832	645
Nevada	327					327	41
New Mexico	332	4		11	4	351	12
North Carolina	5					5	
Oregon	498	11	3	5	4	521	303
South Dakota	354	10	6	9	2	381	97
Utah	600	8	2		2	612	83
Virginia	27	1				28	1
Washington	126	3	2	5	6	142	4
Wyoming	310	3	5	5	2	325	161
Alaska	317	11	9	10	1	348	
Total, 1914	7,926	146	64	108	54	8,298	2,341
Total, 1913	5,696	209	73	142	62	6,182	91

There has been a significant increase in the amount of timber sold at cost to homestead settlers and farmers, under the act of August 10, 1912. These sales last year are shown in the following table:

Timber sold and cut under sales at cost rates.

State.	Number of sales.	Timber sold.		Timber cut.	
		Quantity.	Value.	Quantity.	Value.
		Board feet.		*Board feet.*	
Arizona	13	22,000	$27.84	41,000	$39.88
Arkansas	17	46,000	34.46	23,000	17.43
California	135	960,000	483.62	593,000	294.12
Colorado	200	1,366,000	1,031.23	464,000	351.59
Idaho	627	3,886,000	2,883.94	2,862,000	1,859.75
Minnesota	2	3,000	2.22	3,000	2.22
Montana	645	3,692,000	2,888.74	2,959,000	2,255.58
Nevada	41	223,000	113.37	211,000	107.08
New Mexico	12	54,000	37.88	27,000	20.57
Oregon	303	1,559,000	806.84	862,000	446.35
South Dakota	97	1,044,000	733.86	772,000	563.54
Utah	83	406,000	303.62	222,000	165.46
Virginia	1	1,000	.78	1,000	.78
Washington	4	32,000	14.70	25,000	11.30
Wyoming	161	913,000	672.24	580,000	434.33
Total	2,341	14,207,000	10,035.34	9,645,000	6,569.98

The 14,207,000 board feet sold compares with only 718,000 feet sold during the preceding year. Under the regulations established by

the Secretary of Agriculture, the homestead settlers and farmers on the National Forests and in their vicinity obtained this timber at an average cost of 70 cents per thousand feet. The cut of 9,340,000 board feet, on the basis of actual value, represents a revenue of approximately $20,000 from the National Forests, which is made available by Congress for the benefit of certain classes of citizens.

EXTENSION OF TIMBER ESTIMATES.

During the fiscal year 2,219,665 acres of National Forest timberland were mapped and estimated. An additional area of 6,858,280 acres was cruised rapidly to obtain the most essential data regarding the condition and character of the timber.

As has been reported previously, continued work of this character is essential to maintain the timber-sale business. Under the present appropriations for the work of the Forest Service, with no specific provision for timber reconnaissance, this important activity is conducted with such parings as are possible from the funds for administration and protection. A special fund which will permit timber reconnaissance each year on a sufficient scale to maintain the sales business is urgently needed. This fund should also be available for administering new sales which are not provided for in appropriation estimates.

TIMBER TRESPASS.

Receipts for timber cut in trespass were $12,981.91, as against $14,207 in 1913. Timber trespass on the National Forests is almost everywhere diminishing, and is no longer a factor of any importance.

TIMBER SETTLEMENT.

Settlements for timber cut in connection with the occupancy of National Forest land for rights of way and other special uses totaled $39,927.11. During the preceding fiscal year $35,133.27 was received from the same source.

FREE USE.

The free use of National Forest timber by settlers, local residents, and prospectors varies but little from year to year, from 35,000 to 40,000 permits being issued annually for this use of the National Forests. Additional amounts are taken without permit from the National Forests in Alaska and from designated areas of dead timber elsewhere, where substantial compliance with the requirements of the Forest Service can be secured. The free-use business is shown, by States, in the following table:

Free-use permits, fiscal year 1914.

State.	Permits.	Free use timber cut.	
		Quantity.	Value.
		Board feet.	
Arizona	1,940	4,600,000	$14,882.83
Arkansas	69	177,000	602.75
California	2,915	8,416,000	15,250.47
Colorado	3,654	12,726,000	17,762.44
Florida	25	310,000	905.00
Idaho	7,434	21,183,000	30,295.67
Michigan	20	135,000	66.30
Minnesota	30	98,000	244.75

Free-use permits, fiscal year 1914—Continued.

State.	Permits.	Free use timber cut.	
		Quantity.	Value.
		Board feet.	
Montana	6,158	19,559,000	$33,815.46
Nebraska	13	6,000	65.00
Nevada	402	1,563,000	3,378.08
New Mexico	2,978	12,285,000	20,272.21
North Dakota	168	56,000	67.22
Oklahoma	1,473	369,000	369.00
Oregon	2,826	12,277,000	15,888.01
South Dakota	1,309	5,635,000	5,028.40
Utah	5,592	10,285,000	12,659.10
Virginia	38	35,000	25.90
Washington	627	2,347,000	2,479.85
Wyoming	1,795	8,513,000	9,164.65
Total, 1914	39,466	120,575,000	183,223.09
Total, 1913	34,264	121,750,000	191,824.77

Of the total amount taken, 31,826,000 board feet was live timber and 88,749,000 dead, with respective values of $85,159.93 and $98,063.16.

The total value of the material cut under free use, $183,223.09, is in effect added revenue from the National Forests which has been made available by Congress for the benefit of certain classes of citizens.

PROTECTION.

LOSSES BY FOREST FIRES.

Unfavorable weather conditions in the summer of 1913 made the task of fire protection difficult and resulted in larger losses than those of 1912, which were the smallest in the history of the Forest Service. While complete figures for the 1914 fire season are not yet available, since the season has not closed, the current calendar year has confronted the Forest Service with the severest test of its ability to prevent widespread destruction of public and private property on the National Forests experienced in any year since 1910, the year of the great fires.

The following table shows the number of fires during the calendar year 1913, and their causes:

Fires on National Forests during the calendar year 1913.

Extent of fires and amount of damage.	Number of fires.	Per cent of total.	Causes of fires.	Number of fires.	Per cent of total.
Under ¼ acre	2,165	47.90	Railroad locomotives	543	12.01
Between ¼ and 10 acres	1,113	24.62	Lightning	1,571	34.76
10 acres and over; damage under $100	1,080	23.90	Incendiarism	452	10.00
10 acres and over; damage $100 to $1,000	137	3.03	Brush burning	232	5.13
10 acres and over; damage over $1,000	25	.55	Campers	513	11.35
			Sawmills, donkey engines, etc.	66	1.46
			Unknown	886	19.60
			Miscellaneous	257	5.69
Total	4,520	100.00	Total	4,520	100.00

The degree of hazard to which the Forests are exposed necessarily varies within the widest limits from one season to another. Efficient fire protection requires, therefore, an elastic organization capable of

swift enlargement to meet conditions of unusual danger, and the most careful prevision to be ready against all emergencies. In the current year the protective system has been put to a very formidable test, which it has met with success. The greatest handicap under which National Forest administration and protection now labors is the lack of sufficient funds when a serious fire situation has to be met. Limited emergency funds are, under the terms of the annual appropriation act, made available by Congress for use under such conditions, but the amount has proved far too small to meet the needs of a season like that now drawing to a close. To prevent widespread disaster large protective forces have been thrown into the breach by the use of funds appropriated for the expenses of general administration; but unless these are made good by a deficiency appropriation much of the work on the Forests will have to stop before the close of the fiscal year 1915, to the serious inconvenience of the public and injury to the interests of the Government.

The timbered area burned over in the calendar year 1913 was 290,143 acres, and the open 157,172 acres. The loss in timber destroyed or damaged was 58,753,000 board feet, with an estimated value of $81,686; in the value of reproduction destroyed, $107,210; and in forage, $2,424. Although private lands comprise only 11.59 per cent of the gross area within the Forest boundaries, they furnished 25.84 per cent of the total area burned over, 12.35 per cent of the volume of timber destroyed, and 17.90 per cent of the total value of the timber destroyed.

The total sum expended during the calendar year 1913 for fire fighting, in addition to the salaries of the regular Forest force, was $102,113, of which $30,667.96, or 24.17 per cent, was for fighting fires on private lands either within the Forests or outside, but so located that the fires threatened National Forest timber.

PREVENTION OF INSECT DEPREDATIONS.

In the prevention of losses from forest insects, special emphasis has been given to reconnaissance, or expert inspection, of the National Forests to learn what damage is being done and to locate incipient attacks where control work is most needed. Ten Forests were covered in district 5 (California) and portions of four Forests in the yellow-pine belt of eastern Oregon, where former damage has been extensive. In western Montana and northern Idaho reconnaissance has been confined to the valuable stands of white pine, in which serious infestations of *Dendroctonus monticola* have occurred within the last three years.

It is not possible to prevent insect damage where minor infestations are scattered over very large areas, and extensive infestations in very inaccessible regions can not always be checked at a practicable cost. Control operations have therefore been concentrated on the more accessible and valuable timber stands threatened. Approximately $10,000 was expended during the year in stamping out attacks of *Dendroctonus brevicomis* in yellow-pine timber on the Stanislaus, Sierra, Trinity, and Klamath National Forests in California. Successful operations were also conducted on the Deerlodge and Flathead National Forests in Montana and on the Ochoco National Forest in Oregon.

Experimental work has been initiated in each region where insects are active to determine such factors as the length of time during which insect-killed timber remains sound, the width of natural or artificial barriers necessary to check attacks, the period of swarming of various species, and the conditions causing a normal occurrence of insects through the forest to develop into a dangerous infestation.

CONTROL OF FOREST-TREE DISEASES.

The past year has further demonstrated the need for technical study of tree diseases in order to conduct the timber-sale business so as to utilize deteriorating material where practicable and rid the forest of infection. Under cooperative agreement with the Laboratory of Forest Pathology in the Bureau of Plant Industry, it is planned to assign an additional expert to this work in Oregon and Washington as soon as possible.

A study of mistletoe affecting western larch in eastern Oregon has shown that 25 per cent of the larch timber over large areas has been weakened or killed by this disease. The information obtained on the distribution and requirements of the parasite will be practically applied in the methods of cutting such stands.

Nearly all large timber-sale contracts now carry a clause requiring the cutting of snags and diseased trees, devised by one of the pathologists assigned to this work. A study on the Shasta National Forest, California, to determine the economic operation of this clause showed a substantial gain in the amount of merchantable timber yielded by the cutting, in addition to the improved condition of the forest.

REFORESTATION.

The most important feature of the reforestation work was the increased emphasis placed upon the planting of nursery stock as against sowing tree seed. Experience shows that in most of the National Forests direct seeding is much less certain of success than planting, and, in spite of the lower initial cost, is more expensive per acre of well-stocked forest. Losses from rodents and drought have made resowing of the same areas necessary in many cases to secure satisfactory stands.

On a few exceptionally favorable areas, forests can be established by direct seeding at a cost of $5 per acre or less. On Forests like the Arapaho, in Colorado, where excellent results have been obtained from sowing lodgepole pine, and the Black Hills, in South Dakota, where some 4,000 acres have been restocked with yellow pine by this means, direct seeding will be continued. Elsewhere progress will be made in the reforestation of denuded lands by planting nursery-grown trees. The area planted during the year was increased to 14,000 acres, while but 6,400 acres were seeded. In the future it is planned to restock approximately 14,000 acres annually by planting and to reduce direct seeding to about 2,500 acres. The latter will include further experiments to check former results and demonstrate all the possibilities of this method in the various National Forest regions.

While the completion of a series of experiments has demonstrated the greater effectiveness of planting, the extension of this work has

been made more feasible by other developments in the reforestation work. The first of these is the completion of adequate nursery equipment to conduct planting operations on the scale now proposed. A second is the perfection of nursery technique so that planting stock better adapted to the needs of each locality is being produced. Finally, by the use of improved methods and wider spacing, the total average cost of plantations has been brought down to about $9 an acre, a factor of the utmost importance in making more extended use of this method.

The reforestation work is being conducted chiefly on denuded lands of two types. The first consists of burns in the main forest belts of the West and Northwest, where conditions for tree growth are most favorable, and hence where the largest returns in the production of wood will be obtained. The second consists of watersheds used for municipal supply, where extension of forest growth will better both the regularity and the purity of streams. The general attention now being given by western cities to protecting the sources of municipal water supply and the demand for special legislation for the protection of city watersheds on public lands makes this phase of reforestation exceedingly important.

Reforestation work is being expanded in the Lake States, where the National Forests contain large areas formerly timbered with pine but now denuded. Nurseries are being developed on the Michigan and Minnesota Forests to furnish more planting material for local needs.

Special mention should be made of the planting on the sandhills of western Nebraska. Since the completion of the initial experiments several years ago, substantial success has been obtained in every year's plantation. Some of the 10-year-old jack pines now have a height of 15½ feet and a diameter breast high of 4.2 inches. A small amount of seed collected from the first plantations was sown in the nursery in 1913.

THE WORK OF THE YEAR.

During the year the following amounts of seed were secured by collection and purchase:

Tree seed collected and purchased.

Source.	Conifers.		Hardwoods.	
	Clean seed.	Average cost per pound.	Clean seed.	Average cost per pound.
Collected by the Forest Service:	*Pounds.*		*Pounds.*	
District 1	2.50	$8.00	.....	.....
2	1,988.70	1.92	53.75	$0.11
3	110.00	.75	.....	.....
4	665.00	2.81	.....	.....
5	18.38	2.66	.....	.....
6	60.50	.63	.....	.....
Total	2,845.08	2.07	53.75	.11
Native species purchased	301.50	1.52	120.00	.29
Exotic species purchased	14.00	.99	38.50	.43
Grand total	3,160.58	2.01	212.25	.27

The total amount of seed secured, 3,160 pounds, was less than one-tenth of that obtained in 1913. The principal reasons for such a marked decrease are the curtailment of the direct-seeding work and the fact that a large amount of stored seed was already on hand. The very scant seed crop and the small amount collected account for the comparatively high average cost of $2.01 per pound.

The reforestation work of the year is shown, by States, in the following table:

Planting and sowing, by States.

State.	Area planted.	Area sown.	Total.	State.	Area planted.	Area sown.	Total.
	Acres.	*Acres.*	*Acres.*		*Acres.*	*Acres.*	*Acres.*
Idaho	3,908.69	1,177.95	5,086.64	California	224.09	5.15	229.24
Oregon	2,464.10	2,503.20	4,967.30	New Mexico	97.12	2.16	99.28
Montana	3,383.88	642.00	4,025.88	Kansas	38.40	.33	38.73
Colorado	1,153.95	579.25	1,733.20	Minnesota	33.10	.....	33.10
Utah	1,060.39	630.00	1,690.39	Nevada	16.55	15.00	31.55
South Dakota	228.50	867.25	1,095.75	Wyoming	17.44	6.05	23.49
Nebraska	598.06	.....	598.06	Arizona	12.80	4.00	16.80
Michigan	407.57	.....	407.57	North Dakota	1.33	.....	1.33
Washington	399.20	.....	399.20				
				Total	14,045.17	6,432.34	20,477.51

In all, 9,400,000 trees were planted and 10,870 pounds of seed sown. As in previous years, western yellow pine and Douglas fir were the chief species used.

The average cost of direct seeding was $1.13 per acre greater than that for the preceding year. This is due to greater efforts to prevent rodent depredation, to more careful methods of sowing, and to increased technical supervision. The average cost of planting, on the other hand, shows a decrease of $2.09 per acre. This is due in part to the wider spacing generally used in plantations, and in part to increased efficiency in the work.

The stock on hand at Service nurseries on July 1, 1914, was as follows:

National Forest nurseries and stock on hand.

Nursery.	Forest.	State.	Seedlings.	Transplants.	Total.
Boulder	Helena	Montana	825,500	227,300	1,052,800
Cass Lake	Minnesota	Minnesota	439,000	96,000	535,000
Fort Bayard	Gila	New Mexico	124,500	87,900	212,400
Gallinas	Pecos	do	168,825	29,800	198,625
Garden City	Kansas	Kansas	441,200	22,450	463,650
Halsey	Nebraska	Nebraska	4,556,500	1,536,600	6,093,100
Kansas	Kansas	Kansas	157,600	153,600	311,200
Monument	Pike	Colorado	1,615,595	706,300	2,321,895
Pilgrim Creek	Shasta	California	30,000	246,700	276,700
Pocatello	Pocatello	Idaho	2,393,400	11,000	2,404,400
Savenac	Lolo	Montana	3,973,000	3,155,000	7,128,000
Silver Creek	Michigan	Michigan	279,000	57,000	336,000
Silverton	Snoqualmie	Washington	306,000	320,000	626,000
Uinta	Uinta	Utah	2,345,500	154,000	2,499,500
Wasatch	Wasatch	do	2,951,000	405,000	3,356,000
Wind River	Columbus	Washington	1,103,000	1,808,400	2,911,400
13 smaller nurseries	.....	.....	425,725	145,090	570,815
Total	.....	.....	22,135,345	9,162,140	31,297,485

The output from the nurseries was approximately 2,650,000 seedlings and 7,500,000 transplants, or a total of 10,150,000 trees. Of these 46,500 were hardwoods. The average cost of seedlings was $3.62 per thousand and of transplants, $5.66. Five thousand and twenty pounds of conifer seed and 94 pounds of hardwood seed were used at the nurseries. A number of small nurseries were discontinued.

FREE DISTRIBUTION OF PLANTING STOCK.

During the year 248,500 trees were distributed to 712 settlers in the Kinkaid district, Nebraska, under the act of March 4, 1911. This is an increase of 59,500 over the previous year. Each applicant received 100 hardwoods, 100 western yellow pine, and 150 jack or Scotch pine.

Reports on the results obtained from trees distributed in 1913 were received up to December 1 from 58 per cent of the recipients. These indicate that 46.6 per cent of the trees were alive in the fall of 1913. As the year was an unusually trying one, this is as high a per cent as could be expected from trees sent to all classes of people in a region where soil, moisture, and climatic conditions are so rigorous.

RANGE MANAGEMENT.

After eight years of experience, the stock growers are, of all National Forest users, the best satisfied with the results of properly regulated use. Within the year their accredited representatives have urged upon Congress the application of the same method of control to the unreserved public domain, because of its practicability, adaptability to widely varying conditions, and fairness to all dependent interests. Range management within the National Forests involves over 100,000,000 acres of land, 1,600,000 cattle and horses, besides their calves and colts, and 7,600,000 sheep and goats, besides their lambs and kids. The permittees who graze these stock number almost 29,000. In addition there are several million head of stock which spend from 1 to 40 days upon the Forests while crossing to private lands or to points beyond, several hundred thousand head which are grazed under permits issued because of unfenced private lands, and several hundred thousand more grazed by settlers and campers entitled to free use of National Forest range. The supervision of these enormous numbers of stock, and of their handling in such manner that when they go to market they will leave the Forests in prime condition without impairing the forage capital of the Forest lands, is a task of national importance. The grazing fees paid by the stock growers amount to over $1,000,000, their gross receipts from their stock probably exceed $30,000,000, their invested capital is over $100,000,000.

The ideal toward which the Forest Service has worked has been a distribution of grazing privileges equally fair to all applicants and productive of the greatest number of well-established successful home units within the regions surrounding the National Forests. During the fiscal year 1914 the increase in the number of permittees was greater than in any previous year, except those when the forest area was undergoing large increases. The National Forest permittees are now essentially small operators. Cooperation with the

stock growers has increased beyond all anticipation and is bearing fruit in the way of improved range conditions, better stock, less damage to forest lands, fewer complaints, and much less friction and misunderstanding. Fifty new associations of stock growers received official recognition during the year. The total number of recognized associations was 164.

The total net acreage of the National Forests was decreased by 1,600,000 acres during the year without decrease in grazing use; a loss of 249,000 sheep and goats was offset by a gain of 63,000 cattle and horses, of which one is equivalent in forage demand to five sheep. The forest lands are markedly improving in condition, productivity, and grazing value. There was room for more stock than was grazed, the numbers authorized by the Secretary of Agriculture totaling 1,891,000 cattle and horses, 66,000 hogs, and 8,868,000 sheep and goats. These figures represented increases over 1913 of 38,000 cattle and horses, 6,000 hogs, and 346,000 sheep and goats. The grazing authorizations are well within the limits of safety. The full numbers authorized were not grazed because owners did not apply for permits.

Thus far it has been possible largely to offset eliminations by bringing new range into use. Systems of roads, trails, and drift fences have been extended; additional sources of water supply have been developed; and added protection has been afforded against losses through poisonous plants, predatory animals, and other agencies which hitherto have tended to prevent the use of much good range. Gains secured in these ways will not continue indefinitely; but no limit can be set to the possibilities of increasing the present carrying capacity through better methods of management and use, supplemented, perhaps, by judicious seeding.

In the early part of the 1913 grazing season the ranges in many parts of the West suffered from deficient moisture, but after July 15 the forage was revived by timely rains. So far as the Forest ranges were concerned, the season of 1913 was a good one. Stock left the Forest in prime condition, weighing out better and shrinking less than in previous years. Except in parts of Colorado and northern New Mexico, where some losses were caused by one big storm, the winter was comparatively mild and open and almost all stock came through well. Hay was plentiful and a good deal remained in the stacks after the winter broke. The season of 1914 opened with the ranges, as a rule, well seeded, well watered, and in better shape than for many years. An unusually good summer followed.

A continued and increasing tendency to raise fewer sheep and goats and more cattle and horses was shown in the fact that the number of cattle and horse permittees on the western Forests increased by 1,579, while the number of sheep and goat permittees fell off by a total of 268. This change is beneficial, since sheep and goats have occupied some forest areas where the grazing of cattle and horses is preferable. In general the western live-stock industry after passing through an evolution is becoming attached to the soil. The itinerant sheep grower and the speculator in cattle are being supplanted on the public lands. It has been the settled policy of the Forest Service to give preference to men who own improved ranch property in or near the Forests and to men who feed their stock during the winter months. Stock growers who have met the requirements imposed largely against their inclinations are now

finding that the ownership of good ranches, improved methods of operation, and winter feeding carry their own substantial rewards in the way of higher grades of stock, better prices, and reduced losses. The effect of this is becoming apparent upon the open public lands also.

PERMITS.

The number of grazing permits issued and the classes of stock grazed, by States, during the fiscal year 1914 are shown by the following table:

Grazing permits issued during the fiscal year 1914.

State.	Cattle, horses, and hogs.				Sheep and goats.		
	Permits issued.	Cattle.	Horses.	Hogs.	Permits issued.	Sheep.	Goats.
Arizona	1,654	262,650	7,973	645	148	391,931	6,201
Arkansas	10	214	6				
California	2,696	175,356	12,487	1,608	348	422,102	10,956
Colorado	3,109	286,532	9,513		393	640,893	1,848
Florida	37	789		73	5	389	
Georgia	69	403	3	73	10	283	29
Idaho	1,731	108,507	9,497	80	698	1,651,525	
Kansas	96	11,006	156		1	125	
Montana	2,074	119,119	16,535		412	753,693	700
Nebraska	63	8,889	841				
Nevada	418	69,188	4,977		105	494,959	
New Mexico	1,667	84,987	13,774	418	514	405,723	38,499
North Carolina	60	417	11	36	10	91	
North Dakota	14	403	110				
Oklahoma	46	4,202	325				
Oregon	1,627	97,920	11,098	433	577	872,829	33
South Dakota	421	9,138	2,332				
Utah	6,560	160,442	12,488		1,499	945,993	
Washington	378	13,424	1,147		132	193,598	
Virginia	17	193	7		2	25	
Wyoming	1,010	94,860	4,961	15	334	786,027	350
Total	23,757	1,508,639	108,241	3,381	5,188	7,560,186	58,616

The number of cattle and horse permittees on the western Forests was greater than in 1913 by 7.2 per cent, but the number of sheep and goat permittees fell off 4.9 per cent. There was a coincident change in kinds and numbers of stock grazed, cattle increasing 51,704 head, or 3.5 per cent, and horses 10,301 head, or 10.5 per cent, while sheep decreased 230,368 head, or 3 per cent, and goats 18,253 head, or 23.7 per cent. These figures are exclusive of the transactions upon lands acquired under the Weeks law, where 146 permits were issued authorizing the grazing of 1,013 cattle and 21 horses, and 22 permits covering 399 sheep and 29 goats.

The average number of cattle and horses per permit dropped to 68 as against 70.5 last year, the eastern permits for very small numbers having some effect on the average. Sheep and goats jumped from 1,448 to 1,469, the natural result of the tendency of small owners to close out their sheep interests and engage in the raising of cattle.

The number of cattle and horses driven across the Forests amounted to 69,609, an increase of 7.4 per cent, but the number of crossing permits issued dropped to 2,385, a reduction of 16.6 per cent, and the total of 4,270,815 head of sheep and goats was 17 per cent less than that of the preceding year. The reduced volume of cross-

ing business is partly explained by the fact that practicable routes of travel are rapidly being blocked by settlers both within and outside the Forests, and sources of water supply and feed upon which the trailing sheep must depend are passing to private ownership, so that many sheep growers must now ship their sheep by rail where formerly they trailed overland. A part of the reduction is due simply to a more exact form of record which prevents the counting more than once of animals driven successively across several Forests.

USE OF PRIVATE LANDS.

Owners of private lands within the Forests who wish to relinquish temporarily use of their lands to the Forest Service are allowed in lieu thereof free grazing permits for an equivalent number of stock. All told, 1,571 permits were issued in lieu of the waiver of 2,592,797 acres of private land, which authorized the grazing of 68,568 cattle, 2,900 horses, 700 hogs, 392,874 sheep, and 1,828 goats. This was an increase of 10.7 per cent in the number of such permits issued and of 6 per cent in the number of cattle and horses grazed, with a decrease of 1 per cent in the acreage relinquished and of 4.1 per cent in the number of sheep and goats grazed.

PROTECTION AGAINST DISEASE AND POISONOUS PLANTS.

Protection of National Forest stock against diseases is secured through cooperation of the Forest Service with the Bureau of Animal Industry and State officials. There was no serious outbreak of disease within any of the National Forests. The quarantine against sheep scabies was raised in Nevada and in 18 counties of California, while in Arizona and New Mexico the rigid inspection of earlier years was discontinued, attention being given only to suspicious cases. Inspection certificates were required upon a few Forests in southern Colorado, in that part of California west of the Sierras, and in Utah.

The Forest Service cooperated with the Bureau of Animal Industry in the survey and construction of a 21-mile fence along the international boundary line in Arizona, to exclude tick-infested cattle from Mexico, and has continued to cooperate with the State veterinarian of Montana in the enforcement of the State law which requires all dairy cattle to be tuberculin tested.

The experiments initiated by the Public Health Service in 1913 to determine the extent to which the grazing of sheep within the infested ranges would reduce the spread of the tick responsible for the spotted fever were continued for 1914, with authority to graze 3,000 head of sheep within the Bitterroot Forest free of charge and without permit. The Bureau of Entomology has also started a series of investigations along the same line, and has requested free grazing privileges for 3,000 sheep upon the Lolo Forest.

In cooperation with the Bureau of Plant Industry the reduction of live-stock losses from eating poisonous plants was studied further at the field station near Greycliff, Mont., and within the Absaroka, Beartooth, Gallatin, Pend Oreille, Caribou, Stanislaus, and Fishlake Forests, where heavy losses from poisoning have occurred. Work was done on death camas, lupines, locos, larkspurs, poison hemlock,

and laurel (Menziesia). Losses of live stock from this cause have been materially reduced and can be further reduced.

PROTECTION AGAINST WILD ANIMALS.

During the fiscal year 1914 Forest officers reported the killing of predatory animals as follows:

Predatory animals destroyed, fiscal years 1913 and 1914.

State.	Bears.		Coyotes.		Mountain lions.		Lynxes.		Wildcats.		Wolves.		Wolf pups.		Total.	
	1913	1914	1913	1914	1913	1914	1913	1914	1913	1914	1913	1914	1913	1914	1913	1914
Arizona	34	5	112	41	69	15	....	1	54	19	20	2	24	....	313	83
California	6	28	337	419	3	....	2	....	132	91	....	2	....	....	480	540
Colorado	21	14	483	373	....	2	7	7	41	33	1	....	24	....	577	429
Idaho	49	25	551	434	2	6	4	7	41	36	5	2	....	....	652	510
Kansas	....	....	4	7	....	....	....	....	....	....	....	....	....	....	4	7
Michigan	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Montana	13	29	186	123	....	1	11	2	12	4	5	34	....	5	227	198
Nebraska	....	....	17	4	....	....	....	....	....	....	....	....	....	....	17	4
Nevada	....	....	64	109	....	....	....	....	4	4	....	....	....	....	68	113
New Mexico	6	9	34	82	3	25	22	6	6	96	8	19	....	1	79	238
Oklahoma	....	....	35	21	....	....	....	....	25	13	....	....	....	....	60	34
Oregon	45	42	320	406	46	4	....	1	92	67	10	4	8	....	521	524
South Dakota	....	....	210	161	....	....	4	14	30	28	9	4	....	....	253	207
Utah	3	32	749	606	3	3	....	2	104	87	....	....	....	....	859	730
Washington	16	31	18	24	7	4	1	12	7	41	....	....	....	....	49	112
Wyoming	13	24	421	356	....	....	11	5	35	14	6	4	41	2	527	405
Total	206	240	3,541	3,166	133	60	62	57	583	533	64	71	97	8	4,686	4,135

The employment of special men to hunt and trap predatory animals has very largely been discontinued. The large majority of the animals reported killed were destroyed by Forest officers in connection with other work and at practically no additional cost to the Government. The trapping and hunting of animals by settlers and other private parties was aided by loans of traps and, in some instances, by furnishing poison. Thus an additional large number of animals were destroyed. The wolf and the coyote, the two species that do by far the greatest amount of damage to game and domestic stock, are transient visitors which frequent the Forests only during the months when game and domestic animals are most abundant. They are bred, born, and spend the major portion of their life cycle in the foothills and flats outside of the Forests. Under these conditions the animals killed on the Forests are replaced by others from the outside ranges, and this will continue to be the case until the Government initiates a general movement to destroy the animals throughout the length and breadth of the public domain.

Poisoning operations against prairie dogs were conducted by the Biological Survey upon the Coconino, Cochetopa, and Pike Forests. Over 40,000 acres were cleared of dogs on the Coconino. On the two other Forests the work will probably be completed this season. There is little likelihood that the dogs will reestablish themselves within the areas treated.

While the work of prairie-dog eradication conducted by the Biological Survey has secured excellent results, the resources of the Survey are far too limited to meet the needs of the Forests, to say nothing

of demands for similar work outside. It would be economically advantageous for the Government systematically to destroy every prairie-dog town now occupying public lands, for the ultimate increase in grazing capacity would more than return the costs of the work.

GAME PRESERVATION.

Most varieties of wild game are essentially products of the forests, and their care and perpetuation has always been one of the duties of the trained forester. Probably three-fourths of all the important wild animals of the Western States find their principal habitats within the National Forests, and the question of their proper protection and perpetuation must be reckoned with in forest management. Except within the two national game refuges, Forest officers protect game under authority derived from the States. Under plans of cooperation perfected with the States of Arizona, California, Idaho, Montana, New Mexico, Oregon, and Wyoming, practically all of the permanently appointed field officers are commissioned as deputy State game wardens. Many of the Forest officers in the other Western States also are deputy State game wardens.

The deer within the Grand Canyon Game Refuge have increased, it is estimated, to 10,000 in number as a result of the active campaign against their natural enemies, the mountain lion and bobcat, together with the almost complete prevention of hunting. There has been a corresponding gain in other species indigenous to the region. The game animals within the Wichita Refuge are all in excellent condition and are slowly but steadily increasing in numbers.

The Utah Legislature created a State game preserve within the Fishlake Forest, and the Wyoming Legislature one within the Shoshone Forest, increasing to 12 the number of Forests containing State game preserves, viz, Beartooth, Bighorn, Boise, Fishlake, Gallatin, Lewis and Clark, Minnesota, Monterey, Shoshone, Superior, Targhee, and Teton. The States aid to some extent in the protection of these areas.

The numerous Federal bird refuges which are situated within the National Forests were posted and protected by the Forest officers as in previous years.

Two plants of elk were made by the Forest Service during the year, one of 24 head on the Colorado Forest, the other of 23 head on the Sopris Forest. Since the distribution of elk began three years ago, a total of about 500 head have been planted in 11 National Forests by the Forest Service, the Biological Survey, and the several States. Almost every consignment has been established on its new range with marked success.

The protection and distribution of elk raises some difficult problems. Elk ranges involve closing land to settlement and grazing use. As the elk multiply a point is eventually reached at which a part of the herd must die of starvation unless new range is provided or the natural increase is utilized through hunting. The flood of settlement has swept up and into the National Forests so strongly that when range is reserved for elk settlers may be excluded from making homes or be denied stock pasturage. The fundamental question is that of the educational, scientific, and sporting value of the elk, considered from a broad standpoint, as against the need for land for

homes, cereals, and domestic meat products. In every case the guiding principle should be that of highest use, consideration being given to all factors.

SPECIAL USES OF LAND.

USE FOR WATER-POWER DEVELOPMENT.

The following statement shows the extent to which water-power development is taking place on the National Forests:

Water power on the National Forests.

Permits.	Transmission lines only.	Power projects, reservoirs, conduits, and power houses.	Estimated average output at minimum stream discharge.
Permits in force June 30, 1914:			
Rental permits—			*Horsepower.*
Preliminary	----	32	349,764
Final	87	86	647,437
Free permits	16	66	70,420
Total	103	184	1,067,621
Constructed or operating June 30, 1914:			
Rental permits	79	52	261,052
Free permits	9	44	5,745
Total	88	96	266,797
Under construction June 30, 1914:			
Rental permits	----	15	93,099
Free permits	2	9	1,190
Total	2	24	94,289
Construction not started June 30, 1914:			
Rental permits	8	51	643,050
Free permits	5	13	63,485
Total	13	64	706,535
Applications received, July 1, 1913, to June 30, 1914:			
Rental permits—			
Preliminary	----	24	----
Final	15	11	----
Free permits	1	8	----
Total	16	43	----

The increase in the amount of power under permit and also the amount in operation was greater than in any preceding year. A gain of 284,021 horsepower, 36 per cent, was made in the total capacity of all projects under permit. Constructed plants with a low-water capacity of 266,797 horsepower more than doubled the 111,200 horsepower available at constructed or operating plants one year previously. Construction has been completed and operation commenced at 20 new plants, and 24 plants, with a minimum-flow capacity of almost 100,000 horsepower, are in process of construction.

The total receipts from power permittees was $47,163.74, a decrease of $4,035.89. Charges paid in connection with the taking out of permits and occupancy of lands prior to the beginning of actual operation are credited against the annual charges to be paid during operation, so that new plants do not immediately become sources of income to the Government.

OTHER SPECIAL USES.

Permits for the occupancy of National Forest lands for other than water-power uses were issued during the year to the number of 5,061; of these, 2,678 were free and 2,383 involved the payment of fees. At the close of the year 16,760 such permits were in force, of which 9,727 were free and 7,033 pay permits. The area covered by those issued during the year was 246,129 acres, and by those in force at the end of the year 903,615 acres. Generally speaking, charge is made only for such use of Forest lands as inures primarily to the benefit of the user. Such uses, however, as make for the development of the country and the general good of the community, although involving an incidental profit to the users, are ordinarily not charged for.

Since the adoption of the permit system for special uses on the Forests in 1905, 36,684 permits have been issued. Of this number, 45.7 per cent remained in force on June 30, 1914, the greater part of the remainder having been issued for temporary purposes only.

PERMANENT IMPROVEMENTS.

The permanent-improvement appropriation for the year was $400,000. This is employed both for maintenance of improvements and for new construction. It is largely supplemented by the incidental use of the time of the regular Forest force. Besides repairing lines of communication and other permanent improvements damaged by the winter storms, 270 miles of new road, 2,153 miles of trail, 3,063 miles of telephone line, 775 miles of fire line, and 106 lookout structures were built. Roads built by use of the 10 per cent fund derived from National Forest receipts brought the total road construction for the year to 642 miles. There were also constructed 118 bridges, 461 dwellings, barns, and other structures, 19 corrals, 316 miles of fence, and 186 water-improvement projects. Included in the above figures are 336 miles of road, 63 miles of trail, 197 miles of telephone line, 147 miles of fire line, 47 miles of fence, 21 bridges, 6 lookout structures, 1 corral, and 14 water improvements built with funds, materials, and labor contributed jointly by the Forest Service and communities, associations, and individuals.

The estimated value of all improvements on the National Forests at the close of the year was $4,553,453. Of this amount, $3,116,937, or 69 per cent, represents works of communication and protection.

ROAD AND TRAIL BUILDING FOR THE PUBLIC.

The 10 per cent of National Forest receipts appropriated for building roads and trails for the benefit of the public made available for expenditure in 1914 $234,638.68 derived from the 1913 receipts, and a balance of $135,262.45 from the 1913 work. There was expended in construction $257,680.35, leaving a balance of $112,220.78 available for 1915 work. The total construction was 441.39 miles of road and 18.87 miles of trail, divided as follows: Arizona, 42.5; California, 48.38; Colorado, 35.40; Idaho, 52.23; Montana, 61.11; Nevada, 42.75; New Mexico, 31.50; Oregon, 50.88; Utah, 43.25; Washington, 17.26; Wyoming, 21.09; and smaller amounts in Alaska, Kansas, Michigan, Nebraska, and North and South Dakota. Of the total, 201.9 miles were constructed in cooperation with States and counties and 124.42 miles with corporations and individuals. Cooperation has included contributions of money, labor, and materials, and the construction or

repair of connecting roads. But for the active and liberal cooperation accorded the construction work would have been much less.

The projects selected for construction now number 197. In selecting projects those are chosen which will be of the greatest benefit to the settlers within and near the National Forests, and chief consideration is given communities that are off the main highways and therefore least able to secure State or county aid. With the funds available it will not be possible, for many years, to build all the roads for which there is now urgent need. It is necessary to leave untouched many projects that but for lack of funds would merit immediate consideration.

By a cooperative agreement with the Office of Public Roads, highway engineers have been detailed to the several district offices to assist in the location, design, and construction of roads.

SCHOOL, ROAD, AND TRAIL MONEY FOR STATES FROM RECEIPTS FUND.

Under existing law, besides the 10 per cent of the gross receipts which is made available for expenditure by the Secretary of Agriculture in building roads and trails for the benefit of the public, another 25 per cent of the gross receipts is paid over to the States by the Federal Government for the benefit of county schools and roads. The amounts available under both the 10 per cent and the 25 per cent clauses of the law during the fiscal year 1914 and the amounts that will be available during the current year from the receipts of that fiscal year are shown below:

Amounts available for States from Forest receipts.

State.	School and road moneys paid to States, fiscal year 1914.	School and road moneys payable to States, fiscal year 1915.	Road and trail moneys expendable by Secretary of Agriculture, fiscal year 1914.	Road and trail moneys expendable by Secretary of Agriculture, fiscal year 1915.
Alaska	$13,126.08	$14,692.09	$5,250.43	$5,876.83
Arizona	74,659.49	63,398.34	29,863.80	25,359.34
Arkansas	12,854.02	9,983.19	5,141.61	3,993.28
California	74,541.55	65,001.84	29,816.62	26,000.73
Colorado	54,922.64	56,340.42	21,969.05	22,536.17
Florida	3,250.51	3,959.41	1,300.21	1,583.76
Georgia		108.44		43.37
Idaho	78,163.90	59,227.81	31,265.56	23,691.12
Kansas	1,148.84	1,207.72	459.53	483.09
Michigan	65.43	78.68	26.17	31.47
Minnesota	201.63	538.72	80.65	215.49
Montana	65,238.15	93,586.06	26,095.26	37,434.42
Nebraska	3,098.59	1,064.38	1,239.43	425.75
Nevada	16,556.89	16,894.47	6,622.76	6,757.79
New Mexico	31,284.15	33,743.49	12,514.99	13,497.40
North Carolina		206.31		82.52
North Dakota	67.72	74.83	27.09	29.93
Oklahoma	673.20	638.87	269.28	255.55
Oregon	55,950.72	61,606.50	22,380.29	24,642.60
South Dakota	11,436.70	14,469.77	4,574.68	5,787.91
Tennessee		20.64		8.26
Utah	34,902.14	37,601.15	13,960.85	15,040.46
Virginia		613.00		245.20
Washington	33,109.69	35,637.54	13,243.88	14,255.02
Wyoming	21,341.35	28,578.50	8,536.54	11,431.40
Total	586,593.39	599,272.17	234,638.68	239,708.06

The States of Arizona and New Mexico received additional shares of National Forest receipts for their school funds on account of school lands included within National Forests, as follows: To Ari-

zona, paid in the fiscal year 1914 from the receipts of 1913, $36,226.65, and payable from the receipts of 1914, $30,730.58; to New Mexico, paid in the fiscal year 1914 from the receipts of 1913, $9,320.65, and payable from the receipts of 1914, $9,890.94.

EXCHANGE OF LANDS.

PRIVATE LANDS.

Practically every National Forest contains a considerable acreage of private holdings. Many of these are checkerboard grants to railroads and wagon roads. Others are patented claims. Many requests for an exchange between the private owner and the Government, whereby the holdings of both will be consolidated, are being received. Aside from the advantages to both of consolidating scattered lands, there is also a growing sentiment in portions of the West in favor of the control and protection of cut-over timberlands by the Government.

A special statute, approved April 16, 1914, authorized an exchange of Government and private lands in the Stanislaus National Forest and Yosemite National Park. The primary purpose of this exchange was to protect forest scenery in the Yosemite National Park. The consolidation of lands was also a factor. A second law, enacted May 13, 1914, authorized an exchange affecting certain private lands within the Sierra National Forest, Cal. A third law, approved on June 24, 1914, authorized exchanges with any private owners in the Ochoco National Forest, of Oregon. All of these statutes are based upon the principle that any exchanges made must be for lands substantially equal in area and value. This basis should be an essential feature of any Federal policy dealing with the exchange of public for private lands. Under the old lieu selection law equal acreages only were required and the values involved were often wholly disproportionate.

STATE LANDS.

The work of examining unsurveyed State school sections in Montana, in accordance with the agreement of December 23, 1912, between the Department of Agriculture and the State of Montana, was vigorously prosecuted. At the close of the fiscal year $13,517 had been expended from the appropriation of $25,000 made by Congress for this purpose, with an approximately equal expenditure of State funds. This exchange will be of mutual advantage to the Government and to the State. In lieu of sections scattered through the Forests the State receives solid blocks of land of equal area and value, the timber and grazing resources of which can be so utilized as to add materially to State revenues. Field work was begun on a similar exchange of lands with the State of Michigan, authorized by the act of July 31, 1912 (37 Stat., 241), which, however, provided no appropriation for the work. Since relatively small areas are involved, the examinations are being made as fast as is possible with the time of the regular Forest force, supplemented by expenditures from State funds.

No further action was possible in connection with the proposed exchange of lands with the State of Washington, mentioned in last year's report, pending the settlement of various difficult legal questions involved.

ACQUISITION OF LANDS.

On recommendation of the Forest Service the National Forest Reservation Commission approved for purchase during the year, under the act of March 1, 1911, 391,114 acres in the Southern Appalachians and White Mountains. The total aproved area is now 1,104,529 acres, of which 190,755.2 acres have been acquired and paid for. On 60,665 acres condemnation proceedings are pending. The remainder awaits the completion of survey or title examination. For the protection, development, and utilization of these lands there have been constructed 92 miles of road, 522 miles of trail, 25 miles of telephone line, and 18 miles of firebreak. Full utilization of the lands is possible only after title has passed to the United States. Receipts from the relatively small acreage owned by the Government amounted to $3,793.56—an indication of the considerable resources of these lands, and of the readiness of the public to avail itself of their use.

The need of developing the purchased lands for the largest possible use by the public has led to the establishment of another administrative district, with headquarters at Washington. This district will also include the National Forests in Oklahoma, Arkansas, Florida, and Porto Rico, since these can be administered economically in connection with the purchased forests in the East. The new district was created effective July 1, 1914.

COOPERATION WITH STATES.

Joint fire protection of navigable watersheds under section 2 of the Weeks law continues to hold the place of first importance in cooperative work with the States. Michigan is the most recent State to avail itself of the opportunity afforded by this act, making 18 States in all. The authorized Federal expenditures for this work are $100,000 per annum, while those of the cooperating States aggregate $450,000.

The allotments and expenditures are shown in the following table:

Allotments and expenditures for fire protection in cooperation with States.

State.	Allotments, calendar year 1914.	Expenditures, fiscal year 1914.	Total expenditures, Mar. 1, 1911, to June 30, 1914.
Maine	$10,000.00	$6,698.75	$27,093.22
New Hampshire	8,000.00	7,109.00	24,018.40
Vermont	2,500.00	1,541.95	5,218.35
Massachusetts	2,500.00	2,907.50	6,649.50
Connecticut	2,000.00	711.00	2,064.25
New York	10,000.00	5,647.07	13,287.07
New Jersey	2,000.00	2,220.00	5,326.33
Maryland	2,000.00	1,528.92	3,007.42
West Virginia	5,000.00	1,796.00	1,796.00
Kentucky	4,000.00	3,253.23	3,253.23
Michigan	5,000.00	.50	.50
Wisconsin	5,000.00	3,476.25	13,187.00
Minnesota	10,000.00	8,992.90	33,069.15
South Dakota	450.00	499.50	499.50
Montana	3,500.00	3,689.66	3,717.16
Idaho	7,000.00	5,778.69	6,937.89
Washington	10,000.00	5,243.25	8,062.00
Oregon	10,000.00	8,697.00	19,422.50
Inspection		1,290.16	1,290.16
Total	98,950.00	71,081.33	177,899.63

The principal forested States to which this cooperation has not been extended, on account of the failure of the States to meet the requirements of the law, are the Southern Appalachian group, those bordering the lower Mississippi, and California. It is earnestly hoped that these extensive forest regions can ultimately be included. Cooperation with the States in the Southwest is less important, since large parts of their timbered areas are within National Forests and are protected by this means.

Assistance in formulating forest policies and drafting forest laws was extended, upon request, to State forestry departments and private associations in California, Colorado, Florida, Georgia, Massachusetts, Michigan, Minnesota, Missouri, New York, Ohio, South Carolina, Texas, Virginia, West Virginia, and Wisconsin.

The effectiveness of this work as a whole has been pronounced. Few serious fires occurred. While the States almost without exception report an increasing number of fires, those burning over more than a few acres have been materially decreased. The percentage of fires of unknown origin is also being steadily reduced.

A cooperative study of the timber resources of North Carolina was continued during the year along the lines of the agreement made with the State several years ago.

NATIONAL FOREST INVESTIGATIONS.

The studies in progress included 144 of reforestation, 38 of forest management, 4 of forest influences, 15 of forest mensuration, and 14 of forest protection. Reforestation studies have already yielded sufficient results to place the current practice on a sound basis, but many phases of the subject require to be worked out further. By 1917 a large part of the reforestation experiments under way will be completed. More attention can now be given to problems in forest management, especially to the study of methods of cutting.

Eight fully equipped and organized forest experiment stations are now maintained by the Forest Service, with an additional station at Cloquet, Minn., maintained by the Forest Service and the University of Minnesota jointly.

Experimental seed-extraction tests are well advanced. It was found that yellow-pine cones open at temperatures even below 90 degrees Fahrenheit, and that, with the exception of the greater time required, the lower temperatures are more economical, but that high temperatures are much more satisfactory for opening lodgepole pine cones and yield a larger amount of fertile seed. In nursery practice it was brought out that broadcast sowing in nursery beds is more advantageous, as a rule, than sowing in drills, and that in the Northwest yellow pine succeeds best in the nursery when grown without shade and Douglas fir produces the best results when grown with no shade or quarter shade, while western larch yields best results when grown under half shade.

Experiments on the best methods of reforestation have brought out almost uniformly the same striking result, that planting nursery-grown trees is a cheaper method than direct sowing of tree seed.

Substantial progress was made in solving the problem of reforestation in Arizona and New Mexico, where natural conditions are very unfavorable to tree growth, and many early failures occurred. West-

ern yellow pine is now being planted successfully, not only at the experiment station, where intensive methods are used, but on several National Forests. The planting of Douglas fir in Arizona proved even more successful than that of western yellow pine. After several years of experiments it is now established that the best season for planting both yellow pine and Douglas fir in the Southwest is early spring. The situation is now believed to be so well in hand that planting may soon be undertaken on an extensive scale with fair promise of success.

On the Tusayan National Forest in Arizona a series of sample plots aggregating 400 acres was established for the purpose of determining the effect of different methods of cutting and brush disposal upon reproduction and growth.

Examinations of about 30 old burns in northern Idaho established that western white pine seed retains its vitality in the duff and litter beneath mature stands from one to four years, and germinates when the ground is exposed to direct light by cutting. Studies made in Douglas fir similarly showed that young growth on burns springs up largely from seed that escapes fire and remains dormant in the ground. These discoveries have great practical significance in the methods of cutting white pine and Douglas fir in timber sales.

Observations were continued at the Wagon Wheel Gap Experiment Station on the effects of forest cover upon stream flow and erosion. The most interesting result of the experiment so far has been the discovery that Rocky Mountain watersheds, at elevations between 9,000 and 11,000 feet, discharge through streams only 28 or 29 per cent of the water which falls upon them in the form of rain and snow. A comprehensive study of forest types, the factors which distinguish them, and their characteristics in relation to the agricultural possibilities of the land is under way at practically all the forest experiment stations. This study will require some years to complete. Studies of the growth, volume, and yield of important trees on the National Forests were continued. A new and much shorter method of finding the cubic contents of trees was tested on nine native species with very satisfactory results. Tables were prepared which will save a large part of the time hitherto required to measure the volume of felled trees.

Engelmann spruce on the Uncompahgre National Forest has been shown to be capable of producing, even on the poorer soils, about 70 cubic feet, or 380 board feet, of timber per annum. A heavy sapling growth of lodgepole pine on the Medicine Bow National Forest showed an annual production of 100 cubic feet of wood and bark per acre. In view of the low productive capacity usually ascribed to Rocky Mountain forests, these facts are of special interest.

Intensive grazing reconnaissance by special parties on the Caribou, Manti, and Wallowa Forests covered 1,219,001 acres, while data for the 1,123,978 acres examined on the Caribou, Manti, Medicine Bow, Minam, Tusayan, and Wallowa Forests during the field season of 1913 were worked up during the winter. Intensive reconnaissance has now covered 5,563,630 acres. Final grazing type maps were prepared for the Coconino, Medicine Bow, and Targhee Forests, involving a total of 2,935,810 acres. In addition to the reconnaissance by special parties, approximately 1,000,000 acres was classified and mapped by local Forest officers. Systematic study and

classification of the range has been started to some extent on nearly all Forests where grazing is of importance.

Artificial reseeding studies were limited largely to the experiments with hardy varieties of Russian alfalfas and 21 promising species of native range plants begun at the Utah and Fort Valley experiment stations in 1912. The principal object of the work is to select or develop native species for use in revegetating the large acreage of depleted range requiring artificial measures, since little can apparently be accomplished with cultivated species. Natural revegetation studies were continued at the Utah Experiment Station and on the Hayden, Eldorado, and Coconino Forests. The aim primarily was to test further, under practical application, the principles of deferred and rotation grazing developed by previous natural revegetation studies.

The studies on the Coconino, Manti, Payette, and Shasta Forests to perfect grazing management along lines which will reduce to a minimum injury to forest growth were continued, and the studies initiated in 1912 on the Manti Forest to work out efficient management of grazing on Alpine lands subject to erosion and floods were enlarged. The study to determine the extent to which grazing reduces danger from forest fires was completed.

Studies in the handling of stock on the range were centered mainly on the handling of sheep. It has been found that open, quiet herding during the day and bedding the sheep where night overtakes them results in 5 pounds increase in the weight of lambs, and from 10 to 15 per cent increase in carrying capacity of the range. Through cooperation with sheep men practical application of this method was made under widely varying conditions, with a precise determination of its value in comparison with the old method of bedding down at established camps. These demonstration experiments will be continued where necessary to work out local difficulties and secure the adoption of the improved system. The experiments on the Cochetopa Forest in the use of small coyote-proof inclosures and sheds in connection with range-lambing allotments were continued. This showed that with the more careful handling thus made possible an increased number of lambs can be saved, with one man less employed per band. Observations relative to grazing sheep on range without water throughout the summer grazing season were continued on the Beartooth Forest and extended to the Uinta Forest. The study on the Inyo Forest to determine the advantages of grazing cattle within inclosures as compared with grazing on open forest lands was continued. This is the beginning of investigations with cattle to determine the advisability, from the standpoint of both range and stock, of more complete control of the stock on grazing lands.

The study of drift and division fences secured further data regarding the best forms of fences for different classes of stock and different conditions and the economic value of control by drift and division fences. Carrying capacity tests were continued on the Deerlodge Forest and extended to the Caribou, Targhee, and Manti Forests. Experimental improvement work to stop erosion and excessive drainage in the small but important mountain meadows of the high Sierras was continued on the Sierra Forest. Additional

data regarding possible new ranges were obtained, and steps were taken to open up a considerable area by water development.

OTHER INVESTIGATIONS.

SILVICULTURAL AND DENDROLOGICAL STUDIES.

The seed-storage investigations begun in 1910 were completed, as were commercial tree studies for eastern hemlock, the ashes, the willows, the northern hardwoods, and bald cypress.

The arboretum in Rock Creek National Park, established in cooperation with the District of Columbia, received additions of 22 new species, bringing the number of species to 92 and of trees to 1,200. The planting of maritime pine on the Florida National Forest was continued with success.

Approximately 25,000 basket willow cuttings were distributed to the State experiment stations, 10,000 to forest schools, and 35,000 to individuals. The study of basket willow culture was substantially completed and the results prepared for publication. This work has developed the value of willow culture as a means of utilizing overflow lands not suited for other crops. All told, over 1,750,000 cuttings have been distributed. Further work will be confined to tests of American varieties and experiments in cross breeding, with the maintenance of a small holt at the Arlington Farm for the continued production of cuttings for distribution.

Three thousand new range records were added to the forest distribution files, and nearly 500 specimens of native and exotic species were identified. Work on the shrubs of the genus Ceanothus was continued.

An extensive study of the economic and silvicultural conditions on farm woodlots as a basis for increasing their productiveness and value to the farmer was inaugurated. Plans for tree planting in connection with coast defenses were furnished the War Department. Eighteen lighthouse reservations in the Lake States were examined and a plan prepared for the management of their woodlands, and assistance was given in the marking and sale of timber on one of the reservations. More active cooperation has been inaugurated with large private timberland owners in the eastern States to ascertain to what extent and under what circumstances conservative forest management is practicable on their lands.

STUDIES OF FOREST PRODUCTS.

UTILIZATION OF NATIONAL FOREST TIMBER.

To assist in accurate appraisal of National Forest timber, plans were perfected for keeping systematic records of current mill prices of lumber and other forest products, and for studies of milling practice to learn the amount and grades of lumber manufactured from logs of the various species, sizes, and qualities locally produced, and from sound and unsound timber of the various kinds grown on the National Forests. Accurate data will be obtained for all important National Forest timber trees regarding the overrun of mill

cut in excess of log scale and on the value of the product manufactured from the various grades of logs, and also on the depreciation of lumber in quantity and in grade during the process of seasoning and finishing. Studies of costs and methods of lumber manufacture and of local manufacturing problems, primarily with reference to the most effective utilization of National Forest timber, included the kiln-drying of western larch in northern Montana (a wood very difficult to season properly), the prevention of blue-stain in seasoning western yellow and sugar pine lumber in California, and the drying of red-cedar shingles in the Pacific Northwest so as not to impair their quality.

As a result of the study of opportunities for establishing new wood-using industries in National Forest regions, the manufacture of pencils from incense cedar is now well established in California and has materially advanced the value of incense-cedar stumpage. Other studies in California have shown the practicability of obtaining hardwood distillates, wood alcohol, acetate of lime, and charcoal from California black oak. Industrial application will probably follow. At the timber-testing laboratory conducted in cooperation with the University of Washington, at Seattle, tests were begun on timbers from the Alaska National Forests to learn their value for structural purposes and the extent to which they can be used in railroad and other construction, where strength is an important factor. It was found at the same laboratory that distillates of turpentine, rosin, and other commercial products are readily obtained from mill waste, woods waste, and stumps of Douglas fir, but with yields too small to promise commercial success under present conditions.

WOOD PRESERVATION.

An important phase of the artificial preservation of structural timbers is the effect of treatment upon their strength. Tests were made on large Douglas fir timbers creosoted at commercial plants to establish definite strength values as compared with untreated timbers. Tests of railroad ties, mining timbers, poles, piling, and paving blocks, following various methods of treatment, under actual use, are in progress in cooperation with 54 railroads, mining companies, pole companies, and municipalities.

In studying the problem of treating wood paving blocks so as to prevent "bleeding" and "buckling," the bleeding of creosoted blocks was reduced in laboratory experiments from 11 per cent to one-half of 1 per cent. An experimental pavement is being laid in Kansas City, Mo., to demonstrate how far bleeding and swelling can be overcome under actual conditions of city traffic. Experimental pavements formerly laid in Minneapolis, Minn., have shown that good results are obtained from blocks of longleaf pine, Norway pine, tamarack, birch, and hemlock. Continued study of the resistance of various woods to creosote injection, with special reference to preserving important timbers grown on the National Forests, yielded excellent results regarding the treatment of lodgepole and western yellow pine.

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Further work was also done on methods of rendering wood fireproof. It has been found that wood treated with proper amounts of ammonium sulphate, ammonium phosphate, borax, aluminum sulphate, or ammonia alum will not ignite and burn. A method was discovered for impregnating shingles with insoluble salts which prevent ignition and can not be washed out by rains.

Over 1,400 tests of the fungicidal properties of 46 commercial wood preservatives were made. Rotting pit and jar tests, with pure cultures of fungi, showed the heartwood of resinous pines, cedar, sequoia, and juniper to be the most durable, and indicate the important relation of resin content to decay resistance. This work was supplemented by investigation of the conditions which promote the decay of structural timber in buildings. Conditions at many sawmills were found to be very insanitary from the standpoint of protecting the soundness and life of the lumber manufactured. Lumber is often infected before it leaves the mill yards with wood-rotting organisms which continue their destructive work after the material is used in buildings. A report on practical methods of mill-yard sanitation is in preparation.

DERIVED PRODUCTS.

Further investigations were conducted on the manufacture of ethyl alcohol from wood waste. White-spruce sawdust was hydrolyzed into glucose with sulphuric acid, and the resulting sugars fermented with yeast. A maximum yield of 23 per cent of sugar was obtained. In the fermentation studies 22 gallons of absolute alcohol have been obtained per ton of dry wood.

The value of osage orange wood as a dyestuff was a subject of study. Further work was done on the determination of the chemical constituents of wood. The butt logs now wasted in the manufacture of western larch timber were found to contain 15 per cent of a soluble derivative of the sugar galactose. This discovery promises to be of importance in the manufacture of ethyl alcohol from wood.

TIMBER PHYSICS.

With the improved dry kiln designed by the Forest Products Laboratory, in which both the humidity and the temperature of the air in the drying chamber are closely controlled, western larch boards 20 inches in width were dried with a degrading loss of less than 5 per cent. The loss in ordinary commercial kilns is often 60 or 70 per cent. Assistance was furnished a number of manufacturers in remodeling and improving old kilns to incorporate the principles of the Forest Service kiln.

The study of the fundamental laws in drying wood was continued. Results were obtained which indicate that shrinkage of lumber is greatest when slowly dried at high temperatures under moist conditions. At the request of manufacturers, engineers, and wood technologists, 360 specimens of woods were identified by microscopic structure. In the study which seeks to correlate the microscopic structure of woods with their properties and commercial uses, it was shown that Douglas fir is impermeable to even the smallest particles of carbon. This has an important bearing upon feasible methods of treating this timber for its preservation.

A study was initiated to determine the relation of the mineral constituents of hardwoods to abnormal brittleness or weakness. In each of the cases investigated the stronger specimens were found to contain the larger percentages of mineral ash, most of them showing a larger amount of potash.

TIMBER TESTS.

Completed tests on 100 species in the continuing study of the mechanical properties of woods grown in the United States have made it possible to establish the relations between specific gravity and some 25 different properties of wood. The old theory that these properties vary with the first power of the specific gravity was found to hold true for shrinkage, for the stiffness of beams, and for the strength of beams under slowly applied loads, but not for resistance to shock, hardness, and other properties. The fundamental knowledge of the properties of wood developed by this study makes it possible to furnish exceedingly valuable information to the lumber trade, engineers, and others on the strength of woods and their suitability for specific purposes.

A new series of tests on yellow pine in structural sizes was begun to check the results previously obtained and published. Tests on wooden barrels in cooperation with the railway Bureau for the Safe Transportation of Dangerous Explosives, with a view to ascertaining the type of construction which affords the best container for the shipment of explosives, enabled a new design for barrels to be worked out which increases strength approximately 25 per cent without increasing materially the cost of construction.

PULP AND PAPER INVESTIGATIONS.

News print paper has been made at the Forest Products Laboratory from 24 different woods, more than half of which are important National Forest species. Many of these papers have been subjected to commercial tests by newspaper publishers. A number compare favorably with the standard spruce news print now in general use. Exceptionally strong pulps suitable for wrapping paper were made from southern pines by the sulphate process. Loblolly and longleaf pine bid fair to become standard materials for the manufacture of "kraft" pulps, used in making high-grade wrapping paper. Enormous quantities of such paper are now imported by the United States. Its manufacture from mill and logging waste and stumps in the southern States should establish a promising industry.

INDUSTRIAL INVESTIGATIONS.

Studies of wood-using industries, by States, showing the kind, amount, and source of the woods used in manufacturing, have now been completed for every State and reports published for 30 States. Starting from this broad survey of the forest-using industries a series of more intensive studies of each important industry which consumes wood has been begun. This study includes the raw materials required, the methods and machinery used, the possibilities of utilizing waste, and special problems of future supply and the like with which the industry is concerned. Studies were undertaken in this series during the year on the cooperage industry, the manufacture of veneer, and the manufacture of boxes.

The study of methods of utilizing blight-killed chestnut in cooperation with the Bureau of Plant Industry was completed and its results published so as to reach practically every owner of diseased chestnut timber.

In cooperation with the Bureau of Crop Estimates an annual census of the kinds and quantities of lumber produced in each State was undertaken and the figures obtained and compiled for the calendar year 1913. In cooperation with manufacturers of southern yellow pine lumber a study was undertaken to devise more effective grading rules and specifications for structural timbers. The specifications in previous use, based upon trade names, have not only caused great confusion, but in many instances have admitted woods not adapted to structural requirements. The object of this study is to learn how far specifications can be based upon the density of the timber.

Cooperation with other Federal departments has been materially extended during the year, particularly with the Panama Canal administration and the Navy Department. This deals with the revising of specifications for lumber, tool handles, and the like, as a basis for bids to supply Government requirements, and with the inspection of material purchased to see that it conforms with the specifications. An inspection of the methods of storing and handling lumber and timbers at the navy yards was begun at the request of the Navy Department.

MISCELLANEOUS.

Twenty-seven new publications were issued, besides revisions of two old ones. In all, 299,500 copies of Forest Service publications were distributed. There were added to the library 726 books and pamphlets, bringing the total number to 17,733, and to the libraries maintained in District and supervisors' offices and the Forest Products Laboratory 4,517 books and pamphlets, bringing the total number in these libraries to 28,548.

Members of the Forest Service delivered 87 public addresses, mainly in response to requests from educational institutions, associations of lumbermen, technical societies, and National Forest users.

Exhibits, consisting of bromide enlargements, transparencies, maps, models, specimens, and charts, were made at the National Conservation Exposition, Knoxville, Tenn.; the Dry-Farmed Products Exposition, Tulsa, Okla.; the National Corn Exposition, Dallas, Tex.; the Forest Products Exposition, Chicago and New York; the Baltimore Exposition, Baltimore, Md.; and the Permanent Country Life Commission, New York. One of these exhibits was supplemented by explanatory lectures. For two of the expositions an appropriation was made by Congress; in the case of the others the expenses involved in making the exhibits were borne by the exposition authorities.

REPORT OF THE CHEMIST.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF CHEMISTRY,
Washington, D. C., October 1, 1914.

SIR: I have the honor to submit herewith a brief report on the work of the Bureau of Chemistry during the fiscal year ended June 30, 1914.

Respectfully,

CARL L. ALSBERG,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

The work of the Bureau of Chemistry, as outlined in the annual report for the year ended June 30, 1913, is distributed among three groups, designated as Regulatory, Standardizing, and Investigational. The same grouping is continued in this report for the year ended June 30, 1914.

REGULATORY WORK.

To further uniformity in the enforcement of the State and Federal food and drug laws, a meeting of State and Federal food and drug officials was held in Washington in November, 1913. At this meeting a joint committee of three members each from the Association of American Dairy, Food, and Drug Officials, the Association of Official Agricultural Chemists, and the Bureau of Chemistry of the Department of Agriculture was formed for the purpose of fixing working standards for foods and drugs. These standards should serve as a uniform guide in the enforcement of the food and drug laws throughout the country and should very largely overcome the lack of uniformity. These standards should, moreover, render food and drug control more economical and make compliance with the laws simpler. This committee has held several meetings and its work is well under way.

At the meeting of the State and Federal food and drug officials it became apparent that some central organization for the promotion of cooperation and the exchange of information would lessen the cost and increase the efficiency of administering food and drug laws by preventing duplication and by encouraging the States and the Federal Government to supplement and assist one another. The Office of State Cooperative Food and Drug Control was, therefore, established in the Bureau of Chemistry. The former Food and Drug Commissioner of Texas was placed in charge. He has already

visited 35 States and has established cooperative relations which will be of great value both to the States and to the Department of Agriculture.

To increase the efficiency of the enforcement of the food and drugs act the Bureau of Chemistry was reorganized during the year. The field service of the bureau was set off from the central organization and divided into an Eastern, a Central, and a Western District, with headquarters, respectively, in Washington, Chicago, and San Francisco. A single official was placed in charge of each district. He is directly responsible to the Bureau of Chemistry for all the work in his district, so that the food and drug inspectors and the laboratories are no longer separate or independent of each other. Incident to this division of the field service of the Bureau of Chemistry, the smaller branch laboratories at Detroit, Kansas City, Omaha, Nashville, Pittsburgh, and Portland, Oreg., were closed. The control through the inspectors of food and drug products in these sections is no less thorough than heretofore. The samples are now analyzed in the larger laboratories, where this work can be done more economically.

Corresponding changes were made in the bureau organization in Washington to make it serve both as a check upon the field service and as a coordinating machine for the work of the three districts. At the same time most of the investigational work of the bureau has been concentrated in Washington, and, as far as feasible, separated from the routine work of law enforcement. It is believed that the best results can not be obtained by requiring both kinds of work from the same set of chemists.

Since January, 1914, food inspection decisions, precedents established in the bureau's policy, and notices of judgment have been published under the caption of Service and Regulatory Announcements. There thus becomes available a complete record of the regulatory activities of the Bureau of Chemistry, which should serve greatly to diminish the bureau's correspondence.

During the year the following food inspection decisions were issued:

Food Inspection Decision No. 152, defining brandy.

Food Inspection Decisions Nos. 153 and 155, announcing the department's intention on May 1, 1916, to cancel all serial numbers issued and all guaranties then on file.

Food Inspection Decisions Nos. 154 and 157, embodying the regulations for the enforcement of the net-weight amendment to the food and drugs act promulgated by the Secretaries of the Treasury, of Agriculture, and of Commerce.

Food Inspection Decision No. 156, defining wine and abrogating Food Inspection Decisions Nos. 109 and 120.

Net-weight amendment.—For establishing "tolerances and reasonable variations," as provided in the net-weight amendment to the food and drugs act, much additional material has been accumulated during the year. The Bureau of Standards of the Department of Commerce has rendered valuable assistance in studying the data collected by the field laboratories. Many hearings have been held and there has been a great deal of correspondence concerning this amendment.

Inspection.—Eight thousand three hundred and twenty-two official and 3,589 unofficial samples have been collected and many factory

inspections have been made. The bureau has sought to broaden and extend the work of the inspectors, who, by cooperation with appropriate officials of other branches of the Government service, have attempted to control and, where circumstances warranted, to suppress altogether the traffic in certain classes of food products where there did not appear to be sufficient means to accomplish this end within the provisions of the food and drugs act. In one instance 15 indictments for conspiracy connected with the shipment of filthy, decomposed, and putrid eggs were returned. In another, largely on evidence furnished by the bureau, a conviction was secured and a long prison sentence imposed on a manufacturer of beverages containing wood alcohol. Incidentally, a number of offenses against the postal and the customs laws and the internal-revenue act have been discovered and the information furnished to the proper officials.

Importations.—Fourteen thousand two hundred and seventy-five shipments were examined and 4,524 were denied entry. In cases where misbranding could be corrected entry was permitted after the goods were properly relabeled.

It has been the practice of many importers to give bond, take possession of goods, and dispose of them before the examination by the Bureau of Chemistry has been completed. When subsequently the goods were reported to the collector as adulterated or misbranded, the importer, having disposed of the goods, was often unable to return them to the collector for relabeling or exportation. In the past, in such cases the Departments of Agriculture and the Treasury have been rather liberal in releasing the importer from the provisions of his bond. This policy has been changed, and the importers have been held to a much stricter compliance with the law.

The cooperation between the Bureau of Animal Industry and the Bureau of Chemistry with reference to domestic meats resulting from the issuance of Food Inspection Decision No. 151, covering domestic meats and meat products, has been extended to similar products offered for importation. In the past such importations were examined only by the Bureau of Chemistry. As the Bureau of Chemistry had no expert meat inspectors, its examinations were limited to the verification of the foreign meat-inspection certificates offered with the importation. This practice has been changed, and by cooperation with the Bureau of Animal Industry products subject to the meat inspection act offered for entry are examined by the meat inspectors of the Bureau of Animal Industry.

An unusually large variety of food products has been offered for entry, among which were shipments of eggs from China, butter from Australia and New Zealand, and condensed milk from Northern Europe. Many of these were trial shipments from foreign merchants.

Past experience has shown that many seeds used as drugs are offered for entry with excessive amounts of dirt, sand, and stems intermixed. It has been found, during the year, that many of these products are capable of being cleaned mechanically. It is now possible to permit their entry after such cleaning.

With the help of the Bureau of Plant Industry, which exercises control over the importation of seeds for planting, greater attention is being paid to the importation of seeds used for food and feed purposes.

To secure greater uniformity in the inspection of crude drugs offered for entry at the various ports, the Laboratory of Pharmacognosy has been established in Washington, so that the necessary examination of crude drugs may be made under the supervision of one official.

The exclusion under the Sherley amendment of medicine with false and fraudulent statements on the label has been continued, and particular attention has been paid to medicinal waters for which false and fraudulent claims are made.

Domestic foods and drugs.—The Bureau of Chemistry, under the provisions of the Sherley amendment to the food and drugs act, has paid very great attention to domestic medicines and mineral water bearing false and fraudulent labels. Many citations have been issued and a large number of cases developed. Many samples of veterinary medicines have been collected and analyzed. Where the therapeutic claims seemed false and fraudulent the information was submitted to the experts of the Bureau of Animal Industry, and upon their advice many cases have been developed. Among these preparations may be especially mentioned ineffective cures for hog cholera. The position long held by the bureau that water to be properly labeled lithia water should contain enough lithia to produce the therapeutic effect of lithium compounds has been sustained by the Supreme Court of the District of Columbia. Action has been taken in accordance with this opinion. A warning has been issued regarding the use of so-called radioactive waters that contain insufficient radium to be of therapeutic value, and measures are being taken to prevent their exploitation. In consequence of the bureau's action, mineral waters sold as "natural," but which, in fact, contain added carbonic-acid gas or mineral salt, are now properly labeled.

To many wines carbonic-acid gas is, similarly, added for the purpose of simulating a bottle-fermented wine such as champagne or sparkling Burgundy. To discover by examination whether a wine has been artificially carbonated, or is bottle-fermented, or whether a malt liquor has been artificially carbonated, or "kräusered," has been difficult. A method for the detection of artificial carbonation has been developed which is now being tried in practice. Incidentally, observations have been made which may lead to the improvement of the methods of artificial carbonation.

As a part of the work of the Bureau of Chemistry, seeking to maintain the standards of the United States Pharmacopœia in medicinal preparations, a complete study of certain simple household remedies was made from every pharmacy in the District of Columbia. Much carelessness in compounding by retail pharmacists was discovered. Except in the District of Columbia and the Territories, this type of control devolves upon the State, and not upon the Federal Government. It was undertaken by the bureau in the District of Columbia not merely to protect the consumer within the District, but, also, for the purpose of bringing to the attention of State officials the condition of simple preparations as often dispensed by the pharmacist.

Pollution of food products.—Quite as important as holding drug products to the official standards is the protection of the consumer from pollution of foods and beverages. Such pollution may lead to serious epidemics. The policy with reference to milk, outlined in

the report for 1913, has been continued. A new development of this policy was begun at Pittsburgh, Pa. Through a joint conference with the shippers and the railroads, and making use of a recent opinion of the Interstate Commerce Commission, it has been possible to adjust conditions so that, practically, all of the milk shipped into Pittsburgh is refrigerated in transit.

In conjunction with the Public Health Service, and with the assistance of the Bureau of Fisheries of the Department of Commerce, which furnished its steamship *Fish Hawk*, a sanitary survey of the oyster beds of Chesapeake Bay was undertaken. A similar survey was undertaken, independently, in Jamaica Bay, N. Y. Sources of pollution and polluted areas were thus located. Oystermen, when such places are pointed out, transplant their shellfish for a suitable period in unpolluted waters, and, consequently, are able to furnish unpolluted oysters without sacrificing valuable food material.

Canned goods.—Opinions, based upon experiments, have been published concerning the quantity of oysters, clams, and shrimps that should be placed in a can of given size. These opinions are used as a guide by packers and food officials and are leading to the proper filling of containers. A serious abuse still exists in canning tomatoes, the cans being filled partly with tomatoes and partly with water. Methods for the detection of the practice are being studied. The investigation of the deterioration of canned goods, through the solution of tin from the tin plate of the container, has been continued. An opinion based on investigations completed last year, condemning the use of cull beans in canned baked beans, has been issued, and has been supplemented by seizure of such beans en route to the canneries.

Flour and feed.—The practice of making macaroni and similar alimentary pastes from wheats not suited to this purpose has led to the artificial coloring of such products in imitation of products made from suitable wheats, such as durum. The Bureau of Chemistry has proceeded against such products, many of which, besides being artificially colored, are sold under labels so like those found on imported goods as to prove most deceptive. Studies have also been made upon the influence of stacking and shocking wheat on the quality of flour produced therefrom and the kind of bread made from the flour.

The effects of the action of the Bureau of Chemistry with reference to flour-mill by-products are becoming apparent. Fewer feeds than formerly are now found below the guaranty in protein and fat and above the guaranty in fiber. Moreover, the variations from the published guaranty are also smaller. The practice of adding sand to stock feeds has been almost completely eliminated. The addition of screenings to mill by-product feeds without declaration on the label is not to-day a matter of frequent occurrence. A large amount of work has been done upon establishing standards for various mill by-products and similar feeds.

STANDARDIZING WORK.

The Contracts Laboratory, in which much of the examination of samples of materials for contract supplies was done, has been trans-

ferred to the Bureau of Standards of the Department of Commerce. The examination of food and drug products for other branches of the Government service continues in the Bureau of Chemistry.

Naval stores.—The development of permanent and standard type samples of rosin and turpentine was made necessary by the fact that no authoritative standards existed for these articles, which are produced annually to the value of about $50,000,000. The possibilities of misgrading are very great, and the loss of money both to the producer and to the buyer may be considerable. After several years' study, permanent type samples have been devised. These have been submitted at a meeting of naval-stores interests and approved. They are at present undergoing the test of practice at the chief naval-stores centers.

INVESTIGATIONAL WORK.

Vegetable and fruit utilization.—Among the great difficulties with which practical agriculture has to deal are not merely fluctuation of production, which swings from overproduction in good years to underproduction in bad ones, but also deterioration of agricultural products, due to their perishable nature. Agriculture will benefit greatly from any means which can be devised to utilize surplus when production is abundant and to convert perishable products into stable ones that can be carried over from periods of plenty to those of scarcity. The Bureau of Chemistry is paying attention to a number of methods to accomplish this end. Among these may be mentioned the application of cold storage to such products as poultry and eggs, the development of industries based upon agricultural waste products, such as cull fruit and cull potatoes, and the drying of agricultural products to render them nonperishable and cheaper to transport. The drying of agricultural products is certain in the near future to prove most important in the marketing of such products.

The study of the utilization of surplus and cull potatoes, which has been in progress for some time in collaboration with the Bureau of Plant Industry, has been greatly extended. For the present the work is confined to potato drying and starch manufacture. Dried potatoes can be kept indefinitely for stock food and may be far more cheaply transported, since the fresh potato may contain as much as 80 per cent of water. It is proposed ultimately to extend these investigations to the production of potato dextrin and potato glucose, as well as potato starch, all of which have advantages for certain manufacturing purposes over other starches and starch products. The object is to encourage the production of potatoes as a regular part of crop rotation in certain sections where this form of agriculture seems advantageous. Such progress has been made that during the coming year work will be conducted on a small commercial scale.

The study of cull lemons and oranges has continued at Los Angeles upon a small commercial scale. The study of the manufacture of citric acid is nearly completed and the study of the production of lemon oil will probably be completed in the course of the coming year. In addition, the composition of oranges in the course of the ripening season in various localities of California has been studied in order to obtain information for use in the control of the shipping of immature fruit which has been colored by sweating.

In studying grape products it was found that for the storage of different types of grape juice, at freezing temperatures, vats can be substituted for carboys. However, this treatment somewhat changes the character of the juice, owing to the separation of crude cream of tartar. Grape sirups were found to be easily prepared from grape juice by liming and concentration by evaporation.

The Enological Laboratory, maintained at Charlottesville, Va., for the purpose of studying the manufacture of wines and similar fruit products, has been closed. Such work on wines and alcoholic beverages as may be necessary in connection with the enforcement of the food and drugs act will be done in Washington.

From surplus and cull apples two products have been made which promise to be of commercial importance. These are concentrated cider and cider sirup. For the manufacture of concentrated cider the apple juice is frozen solid, the block of ice is crushed, and the crushed ice is introduced into a centrifugal machine which removes the concentrated cider, leaving the ice behind. In this way a concentrated cider is obtained which, when diluted with water, has practically the flavor and qualities of the original apple juice from which it was made. The concentrated cider ferments very slowly at refrigerator temperatures, but at room temperatures fermentation occurs after a few weeks. This is a good example of rendering a very perishable agricultural product both stable and much cheaper to transport. Such concentrated cider can be transported relatively cheaply to great distances and kept in cold storage for long periods. The cider sirup is prepared by clarifying and boiling down apple juice and promises to be of some value as a table sirup.

Jams, jellies, and preserves.—Manufacturers of jams, jellies, and preserves have great difficulty in making a uniform product. The difficulties in obtaining a product of the proper consistency, and in preventing it from granulating through the crystallization of cane sugar, are great. The methods of the manufacturers are largely methods of trial and failure. No definite rules seem to exist which manufacturers can use as a guide in judging the proper amount of sugar to be added or the length of time the product must be boiled. In fact, so far as appears in published records, the manufacture of these products does not seem to have been made the subject of scientific investigations. As it seems probable that the application of well-known principles of chemistry will greatly improve the methods of production, investigation of the processes of manufacture of jams, jellies, and preserves has been undertaken. For example, methods for preparing grape-fruit and orange marmalades for the market are being studied. There can be no doubt that if it proves possible to put the manufacture of such products upon a scientific basis much wasted fruit will be utilized. At the same time, in the course of these investigations, valuable information for use in the enforcement of the food and drugs act is being obtained.

Candy.—The principles of candy manufacture are perhaps in the same unsatisfactory state as those of jams, jellies, and preserves. The books on the manufacture of candy are largely composed of recipes such as are found in cookbooks. Little or nothing is said concerning the principles that underlie the manufacture of candies. Such questions as the means of preventing the granulating of candy,

which causes it to be rejected by the consumer as "stale," or the prevention of the softening of the candy, which makes it unmerchantable, because it becomes sticky, do not seem to be understood. These also seem to be difficulties that can be controlled by the application of well-known scientific principles. Accordingly, chemical investigations of the principles of candy manufacture are being made for the purpose of aiding factory practices.

Sugar.—The suitability of many varieties of granulated sugar for the manufacture of transparent hard candy has been studied. A wide variation in quality has been observed. Some sugars, classed as standard granulated, darken when made into candy. A test referring to color and transparency of the product has been devised for the determination of the suitability of a sugar for making a hard candy.

Cane sugar, sirup, and molasses.—One of the difficulties in the manufacture of cane sirup is to inhibit the granulation due to the crystallization of cane sugar. It has been found that by the use of the yeast ferment invertase this granulation can be avoided. A method for the preparation of invertase for this purpose has been devised. Methods also have been perfected for readily preparing in quantity in a state of purity a number of sugars. Samples of some of these have been supplied to several bacteriologists for use in investigation of problems concerning public health.

Several studies on the physical and chemical constants of pure carbohydrates have been made.

Fish.—With the growing scarcity of meat, fish and other sea foods must more and more be utilized to supply the necessary nitrogenous elements of the diet. Unlike the meat-packing industry, the sea-food industry has not to any considerable degree been made the subject of scientific investigations. Storage, transportation, prevention of waste, and the utilization of by-products are not so well understood in the sea-food industry as in other industries that deal with perishable products. There can be no doubt that investigations in this industry will be as valuable as they have proved in the meat-packing industry or in the transportation of fruit. Studies of the utilization of wastes from fisheries have heretofore been confined largely to the manufacture of fertilizers, fish oils, and glue. They have not tended to conserve the food supply. Careful studies of the best methods of conserving and utilizing fishery wastes are so necessary that an investigation of these questions has been undertaken, in cooperation with the Bureau of Fisheries of the Department of Commerce. During the year the basis has been laid for studies of this kind, which should be of great service in connection with the food supply.

The industry of canning sardines on the Maine coast has received special attention. A temporary laboratory was installed, and investigations were conducted for the purpose of improving the quality of the product and the conditions under which it is prepared. As a result of this work a marked improvement of the sanitary conditions under which sardines are packed is already noticeable.

Poultry and eggs.—The demonstration of improved methods of packing, refrigerating, and shipping poultry has been continued in the producing section. In consequence the installation of mechanical refrigeration, especially in Missouri, is increasing. A system for

the management of egg-breaking plants has been developed, with the result that for a given plant the number of employees is reduced one-third, the output is increased, and the quality improved. The demonstration of this system has resulted in the equipment of a number of model egg-breaking establishments in New York, Pennsylvania, Missouri, Ohio, Minnesota, and Indiana, while plans have already been made for a number of others. The best methods for freezing and drying eggs and their use by bakers and others have been studied. The breakage of eggs in transit has been investigated, in order to devise a means to reduce the tremendous losses resulting from this cause. An instrument to register shocks received by eggs while in transit has been produced. Tests have been made of commercial egg packages, in order that the best method of packing eggs may be discovered. This work has been done in cooperation with packing houses, railroads, and refrigerator car lines. The results obtained should be of great value in lessening breakage.

Wheat and grains.—The results of investigations to determine the influence of environment on the composition of wheat and other grains seem to indicate that climate is the determining factor in the composition of the crop. The grain grown in one locality from seeds from various localities was found to be identical in appearance and composition. The manufacture of macaroni from domestic durum and semolina has been studied. In order to determine the variety of wheat best adapted for a particular locality, milling and baking experiments have been conducted in collaboration with the Bureau of Plant Industry. Experiments also have been conducted on flour mixtures containing substitutes for wheat. Thus, for example, bread has been made from a mixture of 1 part of kafir or milo and 3 parts of flour. Other mixtures studied contained rye, oats, barley, corn, rice, cottonseed meal, soy beans, acorns, banana, or chestnuts.

Pharmacological investigations.—Studies upon the toxicity of sodium tartrate and on the pharmacology of tin and zinc have been made. Further investigations upon the action of caffein also have been made.

Insecticides and fungicides.—Experimental work concerning the injury to fruit trees by poisonous sprays through the medium of the soil has been completed. Study of the preparation of ortho and pyro arsenates of lead is in progress.

In cooperation with the Bureau of Entomology and the Bureau of Plant Industry, an investigation was conducted to discover means to prevent the breeding of the house fly in manure and at the same time to preserve the agricultural value of the manure. It was found that borax properly used prevents the breeding of flies and in no way alters the value of the manure for agricultural purposes.

Utilization of wood wastes.—The industrial experiments in wood distillation described in the report for 1913 were concluded. Analyses of the products, with calculations of cost of extraction of the separate products, were made. In collaboration with the University of Idaho at Moscow, experiments have been undertaken on the utilization of the products that may be obtained by distilling stumps and waste material on cleared land.

Paper investigations.—Proper methods for testing durability of paper are of the greatest importance to manufacturers and to pur-

chasers of paper, of whom the Federal Government is one of the largest. The degree to which humidity affects the testing of paper has been found to be such that no correction for the error due to varying conditions of humidity can be applied. The deterioration of paper was studied by estimating the effect of increase of temperature on folding. Durability of various pulps was also studied, with the result that laboratory tests were found to be in accord with experience in proving that papers from ground wood lack durability. An attempt is being made to learn what materials and what processes of manufacture secure the most serviceable sort of blotting paper.

With the cooperation of the Bureau of Standards of the Department of Commerce and of the Bureau of Engraving and Printing of the Treasury Department, a search has been made for an inexpensive paper of improved quality for use as paper currency. The aim is to secure such a paper that counterfeiting will be rendered difficult.

Leather investigations.—The machine designed for the purpose of testing the wearing quality of leather under conditions closely resembling actual service, mentioned in the report for 1913, has been used in testing leathers prepared from different parts of a number of animals. Studies of the action of varying amounts of sulphuric acid on the durability of leathers and of the utilization of tannery wastes as fertilizers are in progress.

Drug products.—Investigations upon spirits of nitrous ether, aromatic spirits of ammonia, ascaridolic acid, santonin, thujone, paregoric, and dentifrices have been made.

Analytical methods.—In connection with the enforcement of the food and drugs act and various other kinds of work, a number of analytical methods have been studied, including methods for the determination of citric acid; acetanilid and antipyrine in headache mixtures; nitroglycerine in tablets; papain; pepsin; and certain of the heavy metals occurring in insecticide and fungicide preparations. Some of this work has been done in cooperation with the Association of Official Agricultural Chemists.

A study of methods for the determination of lactose and maltose in the presence of other sugars has been begun. Honey has been analyzed to detect the presence of added cane sugar and glucose. Methods for the examination of turpentine, rosin, and wood products have been devised. Owing to the introduction of the hand separator, much cream is being shipped great distances for the manufacture of butter. This cream is often excessively acid, or fermented. In order to manufacture butter from it the acidity of the cream is neutralized with alkali. The recognition of butter made in this way has proved difficult. Therefore, methods of determining whether or not a given sample of butter was made from neutralized cream have been investigated. The study of the clarifying of leather extracts for the determination of sugar has been completed. The determination of free mineral acids in leather which injure its durability also has been investigated. In judging the quality of a leather it is often necessary to be able to determine the material with which it was tanned. The methods of making such a determination are not satisfactory in all respects, and much work has been done in perfecting them.

REPORT OF THE CHIEF OF THE BUREAU OF SOILS.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., September 15, 1914.

SIR: I have the honor to transmit herewith a report covering the operations of the Bureau of Soils for the fiscal year ended June 30, 1914.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

The work of the soil survey has been prosecuted under direction of Prof. Curtis F. Marbut, the work of the chemical and physical laboratories, including fertilizer investigations, under direction of Dr. Frank K. Cameron, and the work of soil-fertility investigations under direction of Dr. Oswald Schreiner.

SOIL SURVEY.

PROGRESS OF THE WORK.

During the fiscal year ended June 30, 1914, detailed soil surveys were completed or begun in 90 different areas located in 29 different States, and 35,721 square miles, or 22,861,440 acres, were surveyed. Reconnoissance surveys covering 11,129 square miles, or 7,122,560 acres, were also conducted in California and Wisconsin. The detailed surveys have been or will be published on a scale of 1 inch to the mile and the reconnoissance surveys on a scale of 4 miles to the inch. The total area covered by detailed surveys since the inception of the soil survey up to and including June 30, 1914, amounts to 329,539 square miles, or 210,904,960 acres, and by reconnoissance surveys, 434,049 square miles, or 277,791,360 acres.

COOPERATION.

Cooperation between the Bureau of Soils and State experiment stations, boards of agriculture, geological surveys, and bureaus and divisions of this department, also with other departments, has during the year been very cordial and mutually helpful. That the results obtained have been of great value to the different communities and to the country at large has been attested in many ways. A great number of requests for the extension of the work have been received from the cooperating States and from those interested in the development of agriculture, especially from the many areas where peculiar conditions of soil and climate exist and where it seems necessary to introduce new crops or new methods for successful competition in the markets of the country.

The demand for the soil survey reports and for maps and reports covering special areas show not only an increase in the number of individuals depending upon this information, but also an increasing number of business lines interested in results of the work.

SPECIAL SOIL STUDIES.

The problem of the proper adaptation of the various soils to the different fruit crops is of great importance, and this study was continued during the year, the work being confined mostly to the State of New York.

A special study of the trucking soils was undertaken, and this work is being continued through the present field season. It is desired to present a complete guide to the soils best adapted to the various truck crops and to indicate the proper methods to be pursued in the handling of each soil.

LAND CLASSIFICATION IN THE NATIONAL FORESTS.

The work of classifying the lands of the National Forests was continued throughout the year in cooperation with the Forest Service. A number of projects have been examined and reported upon, and the work is proceeding in a satisfactory manner.

COOPERATIVE WORK WITH THE RECLAMATION SERVICE.

At the request of the Reclamation Service soil surveys have been made of several of the more important reclamation projects.

In addition to this general line of work, individual requests for soil information have been answered, giving data that this bureau is able to furnish through its acquired knowledge of the soils of the United States.

The following tables give in detail the salient facts connected with the soil survey work for the fiscal year just ended:

Individual areas surveyed and mapped during the fiscal year ended June 30, 1914.

DETAILED.

State.	Area.	Area surveyed.	
		Square miles.	Acres.
Alabama	Barbour County	370	236,800
	Bullock County	[1] 235	150,400
	Cleburne County	[1] 126	80,640
	Escambia County	[1] 452	289,280
	Lawrence County	700	448,000
	Limestone County	596	381,440
	Russell County	[1] 332	212,480
	Washington County	271	173,440
Arkansas	Columbia County	555	355,200
	Mississippi County	792	506,880
	Pope County	[1] 319	204,160
California	Honey Lake area	78	49,920
	Merced area	[1] 497	318,080
	Russian River Valley area	156	99,840
	Southern California area	335	214,400
Florida	Hernando County	497	318,080
	Putnam County	752	481,280
Georgia	Clay County	203	129,920
	Colquitt County	529	338,560
	Gordon County	372	238,080
	Habersham County	283	181,120
	Jackson County	187	119,680
	Tattnall County	642	410,880
	Terrell County	322	206,080

[1] These figures do not include portions of these areas surveyed in preceding years.

Individual areas surveyed and mapped during the fiscal year ended June 30 1914—Con.

DETAILED—Continued.

State.	Area.	Area surveyed.	
		Square miles.	Acres.
Indiana	Clinton County	91	58,240
	Delaware County	392	250,880
	Hendricks County	[1] 153	97,920
	Warren County	120	76,800
Iowa	Bremer County	[1] 295	188,800
	Lee County	75	48,000
	Pottawattamie County	188	120,320
	Webster County	78	49,920
Kansas	Montgomery County	644	412,160
Louisiana	Webster Parish	609	389,760
Maryland	Montgomery County	61	39,040
Minnesota	Pennington County	415	265,600
Mississippi	Clarke County	675	432,000
	Grenada County	295	188,800
	Jones County	[1] 222	142,080
	Wilkinson County	[1] 217	138,880
Missouri	Dunklin County	326	208,640
	Greene County	[1] 465	297,600
	Grundy County	202	129,280
	Harrison County	307	196,480
	Johnson County	154	98,560
	Nodaway County	[1] 739	472,960
	Perry County	[1] 354	226,560
	Pettis County	158	101,120
	Ralls County	[1] 246	157,440
Montana	Bitter Root Valley area	158	101,120
Nebraska	Cass County	552	353,280
	Douglas County	331	211,840
	Gage County	252	161,280
	Saunders County	[1] 356	227,840
	Scotts Bluff County	723	462,720
	Seward County	87	55,680
New Jersey	Freehold area	[1] 96	61,440
New York	Chautauqua County	736	471,040
	Clinton County	141	90,240
	Oneida County	[1] 704	450,560
North Carolina	Bladen County	1,004	642,560
	Forsyth County	396	253,440
	Randolph County	[1] 214	136,960
	Rowen County	80	51,200
	Union County	272	174,080
	Wake County	[1] 584	373,760
North Dakota	Lamoure County	532	340,480
Ohio	Paulding County	47	30,080
	Stark County	[1] 360	230,400
	Trumbull County	29	18,560
Oklahoma	Bryan County	928	593,920
	Muskogee County	[1] 334	213,760
	Roger Mills County	578	369,920
Pennsylvania	Lancaster County	493	315,520
South Carolina	Chesterfield County	837	535,680
	Florence County	607	388,480
Tennessee	Jackson County	301	192,640
Texas	Brazos County	597	382,080
	Smith County	365	233,600
Virginia	Frederick County	70	44,800
Washington	Franklin County	325	208,000
	Stevens County	[1] 3,671	2,349,440
West Virginia	Boone County	506	323,840
	Logan and Mingo Counties	865	553,600
Wisconsin	Buffalo County	[1] 250	160,000
	Dane County	[1] 258	165,120
Total		35,721	22,861,440

RECONNOISSANCE.

California	Sacramento Valley	6,484	4,149,760
	San Francisco Bay region	1,022	654,080
Wisconsin	Central Northern area	633	405,120
	Northeastern area	[1] 2,990	1,913,600
Total		11,129	7,122,560

[1] These figures do not include portions of these areas surveyed in preceding years.

Total areas surveyed and mapped in the several States during the fiscal year ended June 30, 1914, and the areas previously reported.

DETAILED.

State or Territory.	Work during 1914.	Work previously reported.	Total.	
	Sq. miles.	*Sq. miles.*	*Sq. miles.*	*Acres.*
Alabama	3,082	32,722	35,804	22,914,560
Arizona		611	611	391,040
Arkansas	1,666	4,160	5,826	3,728,640
California	1,066	13,394	14,460	9,254,400
Colorado		2,809	2,809	1,797,760
Connecticut		1,704	1,704	1,090,560
Delaware		314	314	200,960
Florida	1,249	6,118	7,367	4,714,880
Georgia	2,538	11,029	13,567	8,682,880
Idaho		1,281	1,281	819,840
Illinois		6,770	6,770	4,332,800
Indiana	756	6,046	6,802	4,353,280
Iowa	636	2,442	3,078	1,969,920
Kansas	644	7,622	8,266	5,290,240
Kentucky		3,069	3,069	1,964,160
Louisiana	609	9,210	9,819	6,284,160
Maine		939	939	600,960
Maryland	61	4,060	4,121	2,637,440
Massachusetts		1,494	1,494	956,160
Michigan		5,015	5,015	3,209,600
Minnesota	415	3,498	3,913	2,504,320
Mississippi	1,409	14,806	16,215	10,377,600
Missouri	2,951	18,549	21,500	13,760,000
Montana	158	432	590	377,600
Nebraska	2,301	4,122	6,423	4,110,720
Nevada		235	235	150,400
New Hampshire		1,411	1,411	903,040
New Jersey	96	2,426	2,522	1,614,080
New Mexico		596	596	381,440
New York	1,581	11,449	13,030	8,339,200
North Carolina	2,550	15,974	18,524	11,855,360
North Dakota	532	7,532	8,064	5,160,960
Ohio	436	4,800	5,236	3,351,040
Oklahoma	1,840	1,640	3,480	2,227,200
Oregon		1,965	1,965	1,257,600
Pennsylvania	493	10,895	11,388	7,288,320
Porto Rico		330	330	211,200
Rhode Island		1,085	1,085	694,400
South Carolina	1,444	13,781	15,225	9,744,000
South Dakota		675	675	432,000
Tennessee	301	7,041	7,342	4,698,880
Texas	962	19,464	20,426	13,072,640
Utah		1,951	1,951	1,248,640
Vermont		227	227	145,280
Virginia	70	6,714	6,784	4,341,760
Washington	3,996	1,847	5,843	3,739,520
West Virginia	1,371	9,359	10,730	6,867,200
Wisconsin	508	9,896	10,404	6,658,560
Wyoming		309	309	197,760
Total	35,721	293,818	329,539	210,904,960

RECONNOISSANCE.

Arkansas-Missouri		58,000	58,000	37,120,000
California	7,506		7,506	4,803,840
Kansas		39,960	39,960	25,574,400
Nebraska		53,064	53,064	33,960,960
North Dakota		39,240	39,240	25,113,600
Ohio		41,420	41,420	26,508,800
Pennsylvania		41,405	41,405	26,499,200
South Dakota		41,400	41,400	26,496,000
Texas		92,297	92,297	59,070,080
Washington		13,115	13,115	8,393,600
Wisconsin	3,623	3,019	6,642	4,250,880
Total	11,129	422,920	434,049	277,791,360

SOIL PHYSICS AND SOIL CHEMISTRY.

Among the activities which have been carried on, the following may be cited as having a general application and interest:

In a study of soil erosion in the South, it has been found that large areas are lost to agriculture annually through erosion. In some States vast areas, amounting to as much as 50 per cent of the arable land of these sections, have been abandoned. The character of the erosion varies with the type of soil. Usually, on the heavy clay soils, "sheet" or surface erosion is found. With increasing proportion of sand in the soil the erosion changes to the "shoestring" type, then to the gully type with rounded edges, and finally to the gullies with caving sides. The most rapid erosion seems to occur in soils having a layer of silt or clay at the surface and a substratum of sand. This condition usually leads to erosion of the deep gully type, which is difficult to check and unprofitable to reclaim.

All methods for prevention and control are based either on increasing the capacity for absorbing the water as it falls, or on decreasing the velocity of the run-off. A new method in use in one locality is the construction of what are known as "christophers," the distinctive feature of this plan lying in the manner of disposing of storm waters. Across an incipient gully is built a dam, through which is passed a sewer pipe connected with an upright pipe on the upper side of the dam. Water fills the valley until it reaches the top of the upright pipe, and then flows down this pipe into the next field. The water left standing below the mouth of the upright pipe is gradually removed by a tile drain. It is also demonstrated in the South that other crops must be grown than those requiring clean culture, as do cotton, corn, and tobacco.

The "critical" or optimum moisture content of soils, as it is known to farmers and gardeners, represents a summation of physical properties and is the only measurement which shows a definite correlation between physical properties of the soil and plant growth. That this valuable soil constant is not more frequently employed in experimental work is due to the fact that its determination is very laborious. A simpler and more reliable method of obtaining this critical moisture content has been worked out, depending upon the rise of water by capillarity a short distance in a tube previously filled with dry soil, and the subsequent distribution of the water in the soil.

Changes in the moisture content of soils produce stresses in a soil which affect tillage operations, and the ease of penetration of plant roots. It has been shown that the stresses produced by wetting a dry soil may be very large, measurements exceeding 50 pounds per square inch having been obtained.

Work on the mineral composition of soils during the year has confirmed their great complexity. Any known element may be expected to be present in any soil, and every soil contains most of them. But the percentages of the different elements and of the minerals which contain these elements differ; and it has been found that those soils in which some one or few minerals predominate are less apt to be agriculturally productive than those in which there is a wide diversity of mineral species in relatively large proportions. The alkali rubidium has been found universally present. Caesium

was found in some soils, and is probably present in all, since it is known to be present in most feldspars and micas, and these minerals are present in practically all soils in considerable quantities. The chemical element potassium is found to be present always in the finer soil material in amounts far larger than could ever be added economically in farm management, a fact antagonistic to efforts to exploit ground silicates as fertilizers. It has been pointed out in former reports on the work that segregation of certain constituents takes place in the different sized particles of the soil. These results have been confirmed, and it has further been shown that segregations exist between soils and subsoils, which probably have an important influence on the nutrition of crop plants and on the problem of deep plowing and other tillage operations. Phosphoric acid, manganese, and silica tend to accumulate in the surface soil, while alumina, ferric oxid, and titania accumulate in the subsoil.

In the chemical investigations on erosion, the silts and sediments carried by the Potomac and Shenandoah Rivers have been carefully studied, the general result showing that while it will be extremely difficult to trace the particular components to their exact origins, owing to the very complete mixing action of the flowing stream, it is indubitably those components most affecting the agricultural value of the land which are most readily removed by rain wash and most readily carried away by the flowing stream. A radical change in the general scheme of soil management seems essential to a control of erosion and soil degradation in river valleys of this type. What these changes should be is fairly well established now, and an enlightened public sentiment is the most important factor in the problem remaining undeveloped.

Important technical improvements have been developed. The application of rapid microscopic methods to soils has been extended to commercial fertilizer materials. The continuous solubility of the principal soil minerals has been further demonstrated, the mechanism of selective absorption of soluble materials by the soil further explored, and the fertilizer value of sugar-mill muds, bat guano, loggerhead sponges, and similar materials examined.

INVESTIGATIONS ON FERTILIZER RESOURCES.

It has been shown that while the extraction of potash from such natural silicates as the feldspars is quite feasible physically, it is not practicable economically, unless some other salable product is produced in the same operation. An investigation into the use of feldspar in the fixation of atmospheric nitrogen showed promise of a practical method of producing ammonia simultaneously with potash from feldspar. The most promising American source of potash, however, is the annual crop of giant kelps on the Pacific coast. Working maps have now been made of nearly all the commercially available kelp beds from the Cedros Islands to the Shumagins, off the Alaskan coast. The area of these beds aggregates nearly 400 square miles, capable of yielding annually, either as dried kelp or as pure potassium chloride, over six times the present consumption of soluble potash salts in the United States, or something more than the world's present total production. The development of a great American industry, based on the conser-

vation and utilization of this important national resource, of fundamental importance to the national agricultural interests, seems now to be a matter of time only.

If all the coal that is now coked in the United States were treated in modern by-product ovens and the ammonia thereby saved, the nitrogen tonnage would be about that now consumed in the fertilizer trade of the country. While the transition from the old "beehive" to the modern furnace method is steadily progressing, the greater dependence for nitrogen carriers yet remains in cottonseed meal, slaughterhouse by-products, fish scrap, and some other less important materials. The growing and insistent demand for more nitrogenous feeds to support the meat production demanded by the dietary customs of the American people is gradually, but steadily, withdrawing these "organic" carriers from the command of the fertilizer manufacturers, while the demand for nitrogen carriers is steadily increasing. The necessity for artificial methods of fixation of atmospheric nitrogen in the United States is not immediately present, but is approaching rapidly. It would be premature to announce the results of the department's investigations as yet, but the types of material which are of commercial promise for American conditions have been pretty well worked out and substantial progress has been made in the investigation of the fundamental technical factors which must control the production of these particular types. At the same time investigation is being made of other possible sources of nitrogen. Following up previous investigation of the possibilities in the fish-scrap industry of the Atlantic coast, already developed, a study has been made of the possibilities on the Pacific coast, including Alaska. The waste fish and fish refuse approximate annually 120,000 tons and can be made to yield about 12,000 tons of scrap (fertilizer) and 3,000,000 gallons of oil, worth, perhaps, $1,800,000. A study is also now under way of the possibilities under American conditions of utilizing garbage and other city wastes.

Although improvements are being made, the wastage of phosphate rock at the mines is still disconcertingly large. In Florida, where the most actively worked fields are situated, investigations of the Bureau of Soils have shown that practically 2 pounds of phosphorus goes to waste for every pound produced in merchantable rock. Studies are now being made looking to the recovery or prevention of some of this wastage by mechanical methods, while several chemical methods have been carefully investigated. One of the latter is a modification of the well-known sulphuric acid extraction, but by "steps." Extraction by electrolysis has been shown to be economically impracticable, but the use of the electric current to produce temperatures necessary for volatilization methods appears very promising, and at least two such methods are now being subjected to factory trials by outside commercial organizations.

Possibilities in the production of phosphatic slags have been demonstrated. The phosphate deposits of Virginia have been investigated in cooperation with the Virginia State Geological Survey. A laboratory investigation has shown the important effects of area and character of surfaces in the chamber process for making sulphuric acid of the grades desirable in the manufacture of superphosphates.

SOIL FERTILITY INVESTIGATIONS.

For a period of years the soil fertility laboratory has been engaged in a study of the organic composition of soils. Organic matter is essential to make a soil of what would otherwise be pulverized and more or less hydrolyzed rock, and while there are some soils capable of growing crops that contain small quantities of organic matter, on the whole the quantity of this material in average soils is considerable. The average organic content of soils amounts to approximately 50 tons per acre, and yet the nature of this material has been but little understood. It has been believed for many years that it consisted chiefly of some such body as humic acid, differing perhaps in different soils, but having the same general properties. One prominent service which these investigations have rendered agriculture has been to show the nonexistence of humic acid and its hypothetical relatives and to show instead the existence of many compounds with many relationships.

This line of research has been especially profitable during the year just past, and the number of compounds isolated and identified has been increased to more than 40. Some of these compounds contain only carbon and hydrogen; some carbon, hydrogen, and oxygen; some carbon, hydrogen, oxygen, and nitrogen; others contain phosphorus or sulphur. Isolation in a pure condition of these organic constituents of soils has made possible the correct interpretation of the changes that organic matter undergoes in soils. The compounds found are recognized as representing decomposition products of fats, carbohydrates, proteins, and other classes of natural compounds, and a great deal of light is shed thereby on the processes of humus formation and transformation in the soil. These researches into the nature and properties of soil organic matter have shown conclusively that the soil investigator must take into consideration the presence of organic compounds in the soil. Prior to this investigation not a single organic constituent of the soil was known. All of the hypothetical compounds designated as humic acids have been shown to have no definite existence. Order has come out of chaos and scientific facts have replaced speculation in regard to the nature, value, and function of soil organic matter. In carrying out these researches great difficulties had to be overcome, and the results thus far obtained are very gratifying. This knowledge of soil constituents is of fundamental importance to every soil investigator, since the organic compounds modify all chemical interactions in the soil, affecting absorption, influencing solubility of minerals, the movement of the soil solution, and the water-holding power of soils. This definite information is therefore of the greatest interest in giving direction and definiteness to many lines of soil investigation and soil management.

REPORT OF THE ENTOMOLOGIST.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ENTOMOLOGY,
Washington, D. C., August 8, 1914.

SIR: I submit herewith a report of the work of the Bureau of Entomology for the fiscal year ended June 30, 1914.

Respectfully,

L. O. HOWARD,
Entomologist and Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

SUMMARY OF RESULTS OF NEW WORK AND OF PROGRESS IN THE OLDER INVESTIGATIONS.

WORK ON THE GIPSY AND BROWN-TAIL MOTHS.

In the 1913 report attention was called to important changes made in the organization of the work carried on against these insects under the direction of Mr. A. F. Burgess of this bureau. During the fiscal year just closed the work has been carried on along the lines laid down in that report. Several of the extensive experimental projects are nearing completion, and good progress has been made in further colonizing and determining the spread of the parasites and natural enemies introduced from Europe and other countries.

Progress of the gipsy moth in New England.—The extensive scouting work which has been carried on during the year around the borders of the infested region has resulted in the discovery of the gipsy moth in 81 towns in Maine, 6 in New Hampshire, 7 in Massachusetts, 17 in Rhode Island, and 7 in Connecticut, in none of which the moth had been previously reported. Eight towns, however, inside the infested area were thoroughly examined and no moths were found. The winter of 1913–14 was one of the coldest which New England has had for many years, and it was impossible to carry on as much scouting work as had been planned. Several isolated colonies in Greenfield, Mass., were examined, and appear to have been exterminated. The somewhat isolated infestation in the region of the towns of Lenox, Stockbridge, and Great Barrington has been thoroughly scouted, and the moths seem to have been nearly exterminated in this region. The isolated colony at Wallingford, Conn., has apparently been exterminated. At Stonington in the same State a few egg clusters were found, and this locality is being cared for by the State.

Gipsy moth in Ohio.—In February gipsy moth egg clusters were found in Bratenahl, a suburb of Cleveland, Ohio, and several men were detailed to scout the estate and surrounding territory. The State nursery inspector of Ohio and the president of the Ohio Agricultural Commission were consulted, and through their efforts very thorough work was carried on to wipe out this colony.

Gipsy moth in New York.—The colony mentioned in the last report at Geneva, N. Y., has evidently been exterminated. In May

a colony of gipsy moths was found on a large estate at Mount Kisco, N. Y. Steps were immediately taken to cooperate with the New York State authorities in stamping out this outbreak. Apparently this colony was of several years' standing; but the New York authorities appreciate the seriousness of the situation, and such good cooperative work has been carried on that there is every hope that the colony will be exterminated.

Need of amended State laws.—In several of the infested States the whole expenditure in control of moths is made by the State, and this becomes inadequate as the number of infestations increases. State laws drawn in general conformity with the present law in Massachusetts, requiring that each municipality do its share toward controlling the moths, would greatly assist in the difficult problem of preventing westward spread.

The brown-tail moth situation.—The brown-tail moth situation has changed materially during the year. The severe winter, coupled with the beneficial work of the brown-tail moth fungous disease and the imported parasites, has resulted in an enormous decrease. This decrease has been generally noticeable, especially in the northern part of the infested region in Maine, New Hampshire, and Vermont. Through the efforts of the New York State inspection service, brown-tail moth nests have been found in several localities on the eastern end of Long Island.

Quarantine work.—The inspection of all forest products and nursery stock moved from the gipsy moth and brown-tail moth regions to other parts of the United States has been carried on continuously and systematically throughout the year. The territory has been divided into districts and an inspector assigned to work in each. His efforts from time to time have been supplemented by extra assistants. This work has undoubtedly prevented the establishment of many colonies in widely separated localities. Seventeen thousand and seventy-six shipments have been inspected and 4,253 specimens of the gipsy moth and 1,404 specimens of the brown-tail moth have been found and destroyed. If this work had been begun years before, the small colonies in New York, Ohio, and the Berkshire region in Massachusetts would not have become established.

Silvicultural work.—The silvicultural work which was begun last year in connection with the Forest Service has been continued throughout the year. Twenty-nine sample plats have been selected in Maine, New Hampshire, and Massachusetts, and thinned in such a manner as to put them in the best silvicultural condition.

Experimental work.—Experimental work on the food plants and feeding habits of the gipsy moth under laboratory and field conditions, together with the more important project of securing more definite data on the actual increase of the moth under field conditions, food plants being considered, has been continued and will be completed by the end of the next fiscal year.

Studies on the wilt disease of the gipsy moth have been continued.

Experiments on the dispersion of gipsy moth caterpillars by the wind have been continued on a large scale.

Studies have also been made of the work of one of the secondary insects which attack injured oak trees, this work being carried on in cooperation by the branch of Gipsy and Brown-Tail Moth Investigations and the branch of Forest Insect Investigations of this bureau.

Introduced parasites and natural enemies.—The introduced parasites of the gipsy moth and the brown-tail moth have been more abundant and conspicuous in their work during the year than ever before. The two species of egg parasites, *Anastatus bifasciatus* and *Schedius kuvanæ*, have been recovered in good numbers. From collections made in the fall of 1913, 67,600 specimens of the former have been colonized in 18 towns, and the species has been recorded from 16 new localities. At the present time this parasite is known to be present in 41 towns, and in many places the percentage of parasitism has been rather high. Commonly, 25 per cent of the eggs in clusters have been destroyed by this parasite, and in one case the percentage has run as high as 43.7. In the spring of 1914, 1,561 new colonies of this parasite were liberated in New Hampshire and Massachusetts, totaling 1,561,000 specimens.

Four other hymenopterous parasites, namely, *Apanteles lacteicolor*, *Meteorus versicolor*, *Limnerium disparis*, and *Apanteles melanocelis*, are evidently well established.

The tachinid fly, *Compsilura concinnata*, has been markedly in evidence, especially in some sections slightly infested by the gipsy moth.

The calosoma beetle, *Calosoma sycophanta*, was found abundantly in very many localities during the spring of 1914. Scouting work the preceding summer indicated that it had spread over a much wider area than heretofore. The beetle is large and conspicuous, and there is no doubt as to its great value as a destroyer of gipsy moth caterpillars and pupæ.

General conditions.—The results of the work during the year have been very encouraging. There is obviously a marked decrease in the numbers of both gipsy and brown-tail moths. The wilt disease and the introduced parasites and beetles have been largely instrumental in bringing about this condition. The entire work, both field and experimental, is showing good results.

Colored posters have been prepared illustrating the gipsy moth and its natural enemies, which have been posted in all the post offices and town offices in the infested district, and copies have been sent to granges and public libraries. Post cards bearing the same illustrations have been distributed by mail and by the Boy Scouts.

DECIDUOUS FRUIT INSECT INVESTIGATIONS.

Mr. A. L. Quaintance remains in immediate charge of the bureau's investigations of deciduous fruit insects. The work as a whole has been a continuation of projects under way during the fiscal year 1913, certain of which have been completed, and a few new ones have been begun.

Apple-insect investigations.—Special attention has been paid to apple-tree borers, especially the roundheaded apple-tree borer, the biology of which has been fairly well worked out. The insect has been found to breed in large numbers in the service berry. It is being studied in typical orchard sections, and by thorough removal of the insect from the orchards and the destruction of its native food plants rather good control seems possible.

The studies of the woolly aphis of the apple have been completed and a report is now in press. Confirming work of other investigators, this insect has been found to winter on elms, on which migrating individuals are developed in the spring and make their way to the apple. This information will be of material value in the control of the

insect on apple, especially on apple nursery stock and in newly planted orchards. It appears that the remedies adopted in certain European countries in the control of the grape Phylloxera should be effective in the destruction of the root form of the woolly aphis. This idea is now being investigated.

Other plant-lice affecting the apple are being studied, especially the so-called rosy apple aphis, which is the cause in some seasons of very severe losses to apple growers. It has been found that effective control work may be accomplished by a single application of a suitable contact spray shortly after the leaves have appeared and before the blossom buds are exposed to any extent.

The work on the codling moth, covering sections of the country not hitherto studied in the comprehensive plan of work against this insect, has been continued. Life-history investigations have been carried on in Maine, and spray testing in orchards has been undertaken in the Pecos Valley of New Mexico. The studies of this insect in the Alleghany region have been completed.

The affection of apples known as stigmonose is the cause of frequent complaint from apple growers. As this trouble may result from the punctures of the fruit by plant-bugs and plant-lice, the bureau has undertaken, in cooperation with the Bureau of Plant Industry, an investigation of this trouble, with headquarters at Wenatchee, Wash.

Peach-insect investigations.—Additional studies of the peach-tree borer were made during the spring of 1913, especial attention being given to the possible value of applications of protective washes.

Investigations of the peach lecanium were completed at the close of the season of 1913. A detailed knowledge of the life history, habits, and insect enemies of the pest has been gained, and an effective remedy in the shape of a mineral-oil spray, applied to the trees in the spring before the opening of the buds, has been found.

Pear-thrips investigations.—The pear thrips, an extremely destructive pest, which made its first appearance in portions of California, is now under virtual control by means of spraying formulas developed by the work of the bureau. The general adoption by the orchardists of the bureau's spray formulas, and their increasing familiarity with the details of pear-thrips control, have proceeded so far that future work against this insect may be greatly reduced, if not discontinued. This insect, however, has become established in several orchard regions in the East. Its general spread throughout the East is probable, and, although the best spraying mixtures have been discovered, their use will be an added expense to eastern growers.

Grape-insect investigations.—It is hoped that the biological studies of the grape Phylloxera in California will be completed by the close of the season 1914. The work of renovating old vineyards infested by this pest—that is to say, maintaining the vine in a thrifty condition in spite of the Phylloxera—gives promise of valuable results.

The investigations of the grape-berry moth, under way for several years and materially reduced in scope in 1913, were enlarged in the spring of 1914 at the request of grape growers in the Erie grape belt, where the pest continues to be a serious menace. The work as planned is proceeding along two lines—experiments in vineyards to determine the effectiveness of various local methods of control, and the investigation of the parasites of the insect with a view to their propagation and dissemination. An effort will also

be made to introduce from Europe certain parasites of near relatives of the grape-berry moth.

Nut-insect investigations.—The studies of pecan insects, under way during the fiscal year ended June 30, 1913, have been enlarged. Experiments in the use of sprays in pecan orchards have been carried out in cooperation with interested growers, and show the effectiveness and practicability of this work.

Investigations of orchard insecticides and spraying machinery.—Tests in orchards on a commercial scale of numerous proprietary preparations have been made, and new sprays have been developed and are being tested for the control of scale insects, the codling moth, and other orchard pests. The "three-in-one" spray, mentioned in the last report, and composed of lime-sulphur, arsenate of lead, and nicotine, is being adopted by many orchardists for the control of biting and sucking insects and of fungous diseases as well.

Cranberry insects in New Jersey.—The work on cranberry insects in New Jersey is being continued, with hope of success. Attention is being paid to the simplification of the methods of preparing and using arsenical sprays in cranberry bogs, and this work promises a considerable reduction in the cost of materials and of spraying.

SOUTHERN FIELD-CROP INSECT INVESTIGATIONS.

Mr. W. D. Hunter has remained in charge of the branch of Southern Field-Crop Insect Investigations, with Mr. George D. Smith in charge of the cotton-boll weevil laboratory at Tallulah, La.

Cotton-boll weevil.—The work of the Delta boll-weevil laboratory, at Tallulah, consisted of practical field experiments in the use of powdered ortho-arsenate of lead, hand picking of cotton squares and bolls, and other experiments looking toward control.

The experiments with arsenate of lead as a means of destroying the weevils on the cotton in the early part of the season were conducted with varying results. Grouping these experiments with those of previous years gives a total of 89 experiments, which have shown an average net gain of $1.86 per acre for the total acreage poisoned over the total acreage unpoisoned. The most uniform gains in production were with from one to four applications, at four to seven day intervals, on Cook's Improved, Blanchard, Foster, and Allen's Long Staple varieties. The question of the extent to which benefits from the use of powdered arsenate of lead may be obtained under practical plantation conditions remains undecided.

Experiments to determine the exact conditions under which the hand picking of cotton squares is practicable were conducted at two points in Louisiana and one in Mississippi. The interval between the pickings varied from 5 to 10 days. All of the squares were examined in the laboratory, and the exact causes of their falling were determined. One of the most interesting results was that the number of squares that fall after July 20 is double the number falling before that time. This shows the great importance of early rather than late work in the fields. The results of the experiments were extremely suggestive, but further investigation is required before specific recommendations regarding the details of square picking can be made.

Many observations were made during the season of 1913 of early and late planted fields in Louisiana and Mississippi. In the vicinity of Opelousas the average yield, for the farms investigated, of seed

cotton per acre on fields planted before May 10 was 942 pounds, and for fields planted after May 10 was only 395 pounds.

Records of the hibernation of the weevil in Spanish moss in January, 1914, made at 12 localities in Mississippi and Louisiana, gave an average of 1,200 live weevils per ton of moss. This high percentage indicates severe damage during 1914 in this region.

Life-history investigations conducted at Victoria, Tex., during the summer of 1913 have proved that the boll weevil has not only changed somewhat structurally since entering the United States, but has become adapted to greater severities of climate and is also now able to obtain subsistence and possibly to develop on certain plants related to cotton, among which are *Hibiscus syriacus* and *Callirrhoe involucrata*.

The discovery of the boll weevil in certain mountain canyons in Arizona, on the so-called Arizona wild cotton, *Thurberia thespesioides*, was followed up by exploratory trips in August and December, 1913, by rearing work throughout the summer of 1913, and by the stationing of an agent in Arizona in the spring of 1914. This western form of the species has shown an even greater adaptivity to climatic extremes than the eastern cotton weevil, and causes considerable fear for the success of western cotton growing.

The dispersion of the boll weevil was carefully mapped during the fall of 1913 in order to aid the various States in maintaining their quarantines. It was determined that 17,700 square miles of new territory became infested during the year. It is estimated that the primary loss in production of the area planted in cotton in 1913 occasioned by the boll weevil was approximately $30,000,000.

Other cotton insects.—The cotton red spider work in South Carolina was continued. The control measures recommended as a result of this work include the destruction of winter food plants, destruction of weeds, such as pokeweed and violets, around the fields, destruction of isolated infestations, plowing of wide dust barriers around isolated infestations, and spraying with potassium sulphid.

An outbreak of the false chinch bug, *Nysius strigosus*, on cotton at Victoria, Tex., resulted in the discovery of a very efficient insecticide, consisting of the liquid obtained by precipitating potassium arsenate in solution with lime.

Tobacco insects.—The work at Clarksville, Tenn., dealt principally with the tobacco hornworms and miscellaneous insects affecting tobacco.

Powdered arsenate of lead, which has been found to be an insecticide that does not injure the dark tobacco, was tested under field conditions of great variability, and these tests confirmed the opinion that it is a safe remedy for use against the tobacco worm.

A study of the hibernation quarters of the tobacco flea-beetle has demonstrated that it shows a decided preference for certain types of cover. It was also determined that the larvæ are capable of doing great damage to infested plants. Careful studies of its spring feeding habits have been made in the effort to determine the advisability of destroying the host plants.

The work upon the cigarette beetle was conducted mainly at Richmond, Va. The effect of low temperatures upon the different stages of the insect has been worked out, and it was found that all stages of the insect can be killed very economically indeed by this method.

The proper method of handling the tobacco to prevent damage during the change in temperatures remains to be worked out. Ammonia gas also promises to be a very cheap and efficient remedy for the destruction of this pest.

Paris green mixed with corn meal has been used solely as a remedy for tobacco budworms in the Florida shade-grown tobacco districts. Owing to the free arsenious acid in the Paris green this method is very dangerous in rainy weather, and the efforts of the agent of this bureau now stationed at that place have been concentrated upon the problem of obtaining a combination of insecticide and carrier that will not damage the tobacco. Antimony sulphid, arsenate of lead, and tripotassium arsenate have given very promising results.

Sugar-cane insects.—A survey of the sugar-cane insects throughout the United States, conducted during 1913, emphasized the fact that the principal distribution of sugar-cane insects is through the shipment of planting cane, and showed clearly the necessity for greater care in selecting and shipping seed cane.

Rice insects.—The control experiments conducted against the rice water weevil at Crowley, La., indicated success from a two weeks' draining begun about three weeks after the first flooding of the rice.

Argentine ant.—The work with the Argentine ant at Hattiesburg, Miss., and New Orleans, La., has demonstrated the utility of sodium arsenate in sweetened solutions as a control measure, provided certain supplementary means are practiced.

INVESTIGATIONS OF INSECTS AFFECTING THE HEALTH OF MAN AND ANIMALS.

The investigation of insects affecting the health of man and animals consisted of studies of malaria prophylaxis, control of house flies in manure, eradication of the Rocky Mountain spotted-fever tick, the possible rôle of insects in the transmission of pellagra, tick life histories, and studies of insects affecting live stock.

An important line of new work undertaken by the bureau was a study of malaria-bearing mosquitoes. The object of the investigation was to obtain exact information on the relation of malaria to agriculture, on the bionomics of the mosquitoes involved in the transmission of the disease, and on prophylactic measures from the standpoint of mosquito control. Very favorable opportunities for the undertaking of this study were found on a large plantation in Madison Parish, La. Through the hearty cooperation of the management of the property and the plantation physician it was possible to obtain much definite information. An intensive study was made of 12 families, cultivating 246 acres of land. These families lost 88 weeks during the crop season from May to October, an average per family of over 7 weeks. Each family cultivated an average of 20 acres of land, a reduction by about 15 per cent of the acreage that could have been cultivated if it had not been for the low efficiency due to malaria. The figures indicate that if this loss were prevented there would be an increased income of $24 per family, and that 57 families without malaria could have maintained the same production on the plantation as did 64 families. It is clear from these figures that the present loss through malaria in the Southern States runs into many millions of dollars.

An interesting feature of the investigation was the connection that was revealed between the malaria problem and the boll weevil. Under normal conditions a loss of time is not a very serious matter,

if it occurs between the time the cotton crop is made and the time of picking. Under boll-weevil conditions, however, both the loss of time and the decreased efficiency become more serious throughout the season. Failure to keep up the cultivation of the crop or to plant at the proper time gives the weevil a decided advantage.

An investigation of the means of controlling house flies by treating manure in such a way as not to injure its fertilizing value was conducted in cooperation with the Bureaus of Chemistry and Plant Industry. As a result of this work it was found that the house fly can be almost completely controlled, and the manure uninjured, by the application of commercial borax at the rate of 0.62 pound, or of calcined colemanite at the rate of 0.75 pound, to 10 cubic feet (8 bushels) of manure. The work on the life history of the fly revealed a migratory habit of the larva, which suggests forms of traps from which manure may be freed of maggots without the application of chemicals.

The eradication of the Rocky Mountain spotted-fever tick in the Bitter Root Valley, Mont., was actively begun in July, 1913.

The investigation of the possible transmission by insects of pellagra was continued in cooperation with the Thompson-McFadden Commission, with field headquarters at Spartanburg, S. C. It now seems unlikely that a blood-sucking insect can have any important relation to pellagra. If an insect is concerned it is much more likely to be the house fly, which may cause the contamination of food after contact with sewage. However, the work on biting insects was continued, and included transmission experiments, with negative results.

The investigation of flies, the larvæ of which attack domestic animals as well as man, was conducted throughout the fiscal year. One of these insects is the screw-worm, which, on account of its constant presence in injurious numbers in the southwestern portions of the United States, has come to be looked upon by stockmen as a necessary evil.

An investigation was carried on, first to determine the species of flies responsible, and, second, to study the biologies of the species concerned, with a view to determining feasible control measures. Contrary to the usual belief, the screw-worm fly, *Paralucilia macellaria*, is not the only species concerned. Three or more other species play an important part in the injury to live stock. The life and seasonal histories of these have been followed out rather completely.

It was found that all of the injurious species breed extensively in carcasses. Looking toward practicable preventive measures, experiments have been inaugurated to determine the effect of burial and of chemical treatment of carcasses on the prevention of fly breeding.

In view of the continued spread of anthrax in southwestern Texas and the probable part which biting flies, especially Tabanidæ, play in the conveyance of the disease from sick to healthy animals, an investigation of this question seemed important. This disease was especially severe during the summer of 1913, and horseflies were unusually abundant. A preliminary survey of parts of the infested territory was undertaken during the late summer and fall of 1913.

The announcement by Dr. C. Gordon Hewitt, head of the Canadian entomological service, of the wide distribution of the European ox warble, *Hypoderma bovis*, in Canada indicated the importance of determining the status of this warble in the United States.

Extensive collections of larvæ, through correspondence, to determine this point, were therefore begun. Investigations were also started to determine more accurately the seasonal history of the ox warble, *Hypoderma lineata*, with a view to suggesting improved methods of suppression.

Some further facts regarding the biology of the stable fly were determined. In tests of the method of hibernation it was found that all adults emerging in the fall succumbed early in the winter. The immature stages continued to develop and produced adults at intervals during the winter, some emerging late in the spring. This indicates the importance of giving proper attention to the destruction of breeding places during the winter months.

Observations have been made during the year to determine the relation of breed and color of cattle to horn-fly attack, and observations have been made upon natural enemies of the pest. Some exportations to Porto Rico of dung-inhabiting beetles, known to aid in reducing the number of horn flies, have been made. These reached the Porto Rican authorities in good condition and give promise of helping control the apparently recently introduced pest there.

Further experiments were made during the year on the relation of the cattle tick to its host, and to climatic factors known to aid in its control in nature. Some work was done at Dallas, Tex., on the effect of dips on the spotted-fever tick, cattle tick, and other important species.

The feasibility of utilizing a tick parasite, which occurs commonly in France, in the fight against the spotted-fever tick of the United States, has been pointed out by Dr. Brumpt, of Paris. Through his kindness two shipments of parasitized ticks were received and utilized in laboratory experiments.

CEREAL AND FORAGE INSECT INVESTIGATIONS.

Work on cereal and forage insects is being carried on under the direction of Mr. F. M. Webster. Many of the insects concerned in these investigations are widespread and must be studied in different parts of the country, since life histories and consequent measures of control must vary to some extent in accordance with climatic variations. For the purpose of studying these widespread species a belt of 15 field laboratories has been established. Important investigations, however, are being carried on concerning species as yet of limited distribution, and prominent among these are the following:

The alfalfa weevil.—Investigations on the important imported alfalfa weevil have been carried on continuously throughout the fiscal year. It has been determined that brush dragging, or the use of an ordinary spike-toothed harrow, with the teeth laid flat, and several layers of open wire fencing stretched beneath is, perhaps, the most easily made and efficient tool that can be used in the fields after the first crop has been removed. Moreover, the use of such a harrow stimulates the growth of the next crop. Valuable results have been obtained from pasturing by hogs during the egg-laying season of the weevil, and practical methods have also been found of poisoning the larvæ in the fields. A spraying method has been developed by which it is possible to protect the first and second crops by a single economical treatment in the early spring.

It has been found that one of the parasites introduced from Europe has established itself in the vicinity of Salt Lake City, and in one field a parasitism of 25 per cent has been found.

The weevil has not spread greatly, but a constant search is being made for indications of spread, and neighboring States are on the alert.

The range caterpillar.—Another of the regional projects that are being carried out is the investigation of the range caterpillar. A field station has been established in the midst of a 100,000-acre cattle range near Koehler, N. Mex. While a number of experiments were carried on with mechanical measures for destroying the caterpillars, it was seen from the beginning that these could not be made of any great practical utility, on account of the wide range of the pest and the diverse topography of the country. For this reason studies have been made of the local parasites and predaceous enemies, and importations have been made of natural enemies which might prove valuable in destroying the caterpillars. Moreover, two species which had been imported from Europe in the gipsy-moth work were collected in New England and sent to the New Mexico camp. A number of these natural enemies have been colonized at different points. It now seems that some of these introductions can easily withstand the climate of the New Mexico plateau and will readily destroy the caterpillars. An assistant of the Bureau of Biological Survey detailed to study the vertebrate enemies of the caterpillar found that skunks destroy myriads of the pupæ.

Insects of wide distribution.—During the year an outbreak of the so-called green bug was threatened in the southern Atlantic region. Owing to weather conditions that enabled the parasites to increase sufficiently, however, this did not prove serious.

Much consternation was caused in late winter by the swarming of the oat aphis in the wheat fields of northern Texas, but the same species of parasite which destroys the so-called green bug became so numerous as to hold the oat aphis in check. It is now evident that it will be necessary for the bureau to exercise a continual surveillance over the southern region, and it is also becoming evident that if a threatened outbreak can be suppressed over two very small areas little damage will occur northward.

Investigations of the jointworm, of the Hessian fly, of white grubs, of wireworms, of the corn leaf-aphis, of the clover stem-borer, of the fall army worm, of the lesser cornstalk borer, and others have been continued at the chain of stations mentioned.

Grasshoppers.—Grasshoppers of different species have been extremely abundant during the fiscal year. Cooperating with the State of Kansas, the bureau was able to assist in carrying out a State-wide war against these pests. The State organized counties in this work, the county furnishing the material for what is known as the poisoned bran bait for the farmers to apply. Most gratifying results were reached by the use of this poison.

An investigation was made of the grasshoppers of the Merrimac Valley in New Hampshire, which will be continued in the hope that we may be able to furnish farmers in that section with information that will aid them in protecting their crops.

Other alfalfa insects.—The clover and alfalfa seed chalcis is being studied most successfully by an expert in southern California, and he has accumulated data which will be of great assistance to the

growers of alfalfa seed. The same insect affects the clover seed, and an outbreak of the clover flower midge has developed in Oregon. This insect also is a serious enemy of the seed crop. Experiments carried on during the present summer in the harvesting of the first crop have shown remarkable results and bid fair to indicate means of almost complete protection to the seed crop.

A new pest to alfalfa, a native weevil known as *Compsus auricephalus*, has developed this year in Oklahoma. It does some damage to alfalfa and also to growing wheat. The life history of this insect has been carefully studied.

INVESTIGATIONS OF INSECTS INJURING FORESTS.

The work on forest insects has continued throughout the year under the supervision of Dr. A. D. Hopkins, and with few exceptions at field stations which cover a large share of the western forested regions, the only eastern station being located at East Falls Church, Va. A great deal of very important work has been carried on during the year.

Demonstration of control methods against the Dendroctonus barkbeetles.—The fiscal year just closed marks the culmination of the work which has been done toward the control of the very dangerous barkbeetles of the genus Dendroctonus, so injurious to conifers in different parts of the country. The final examination of the principal control areas from two to eight years after the control work was done has completely established the practicability of the bureau's methods. The first cost should rarely if ever exceed the stumpage value of the infested timber. If treated timber can not be utilized and must be left to decay, the value of the timber protected by the operation and which would otherwise have died within the next year or two will more than balance the first cost; so that continued protection will represent a cumulative profit.

Work of this character has been carried on by the Forest Service along the lines laid down by the Bureau of Entomology, upon forest reservations, with most gratifying success, while other work carried on by private owners and by railroads and on the Indian reservations under directions from this bureau has been equally successful.

In all of this work the percentage principle of insect control has been applied. This means that in order to protect a forest by no means all of the infested trees must be felled or barked. To treat 75 per cent of those infested will be ample, and in some cases this percentage may be greatly reduced. From 25 to 75 per cent of the infested trees must be disposed of, leaving the remainder of the infested trees to be cleared of barkbeetles by parasitic and predaceous insects, birds, diseases, and so on. This is really an extraordinary discovery and greatly simplifies control work and also greatly lessens its cost.

Interrelation of insects and forest fires in the destruction of forests.—Special investigations show (*a*) that insects are the most important factors in producing favorable conditions for the more serious forest fires; (*b*) that Dendroctonus beetles kill and are the direct cause of the death of more timber than is caused directly by forest fires; (*c*) that the control of Dendroctonus beetles would reduce to a very great extent the cost of the control or prevention of forest fires, while on the other hand forest fires contribute very little to the spread of destructive outbreaks of tree-killing insects.

Agrilus beetles in their relation to forest growth.—It has been shown that while *Agrilus bilineatus* is not as important as a primary enemy of healthy trees as has hitherto been supposed, it is of far greater importance as a secondary enemy of oak and chestnut trees which have been weakened by defoliation or disease than had ever been suspected. This discovery is of great importance in the mixed forests of New England, which have been defoliated by the gipsy moth and the brown-tail moth. Additional information gained in regard to the seasonal history and habits of this beetle has enabled the forest insect branch of this bureau to recommend practical means of control at a minimum cost.

Relation of mistletoe on living trees to attacks by insects.—It has been claimed that a weakened condition of the coniferous trees of the Pacific and Rocky Mountain States offers favorable conditions for attack by Dendroctonus and other bark-boring beetles, and that mistletoe-infested trees lead to such destructive attack. Special investigations during the year, however, indicate that there is no basis for such a claim. On the contrary, it has been shown that trees upon which mistletoe is excessively abundant are less liable to attack by destructive insect enemies than are healthy trees.

Insect damage to forest products.—Investigations in search of remedies for insects which damage forest products have been mainly along the line of experiments with wood preservatives and treatments of different kinds of seasoned and unseasoned wood. Experiments have also been made with various species of seasoned untreated wood to determine their relative immunity and resistance against attack by white ants, or termites. The effective and economical preservatives and treatments have thus been separated from a mass of worthless or expensive ones. Some of the results reached are being put to a practical test by users of telegraph and telephone poles, railroad ties, mine props, and similar unseasoned products, and also by makers of cabinet work, tool handles, and vehicles. With hardwood products liable to attack by the so-called powderpost beetles it has been found that kerosene and linseed oil are effective repellents against these insects. A rather general utilization of these oils by manufacturers has followed this discovery.

Laboratory investigations.—A very large amount of work has been done in the laboratory over the whole field of forest insects. The work is effectively organized, and through its labors the bureau is enabled to give advice concerning practically all of the insects which damage forest trees.

INVESTIGATIONS OF INSECTS INJURIOUS TO VEGETABLE AND TRUCK CROPS.

Dr. F. H. Chittenden remains in charge of the investigation of vegetable and truck-crop insects. The principal work done during the year has been upon insects affecting potatoes, sugar beets, onions, and crucifers.

Potato insects.—The largest problem which has engaged the attention of the experts of this branch has been the potato tuber moth. The insect seems to be spreading, and is now known rather generally throughout southern California, and extends in occasional spots as far north as Shasta County. It has been found in one county in Utah, four counties in Texas, one in Louisiana, and one in Florida. Moreover, its occurrence is suspected in the State of Washington, in northern Kansas, and at one locality in Minnesota. Strong efforts

have been made to warn potato growers of the seriousness of this pest and of the necessity for the rather simple protective and defensive measures.

New insecticides against the Colorado potato beetle and new sprayers for insecticide work against this insect have been studied.

The potato flea-beetle has received much attention, especially on Long Island, this project being now practically completed. Many insecticides have been tried against this pest, and the especially valuable ones act more as deterrents than as destroyers.

Sugar-beet insects.—Continuous work has been done on various sugar-beet pests, and the results are being published as the projects are nearing completion.

Insects affecting cruciferous plants.—The cabbage looper has been under continuous observation and a full report is nearly ready.

Onion insects.—The work on the onion thrips has been continued, and it has been shown that it can be controlled by nicotine sprays in combinations. Better machinery for spraying has been devised.

Other vegetable, truck, and garden insects.—A group of very important pests which have been investigated are the various root maggots which attack cruciferous crops, onions, sweet corn, and root crops generally. Control of these pests is very difficult and is requiring much study. More or less attention has been given to the study of the tomato fruit worm, or corn-ear worm, a very destructive pest which attacks a variety of plants. It has thus far defied all attempts at complete control, although it has been the subject of experiment for nearly half a century.

Practical work on the cutworms which affect garden crops has been carried on in nearly all of the stations of this branch of the bureau, with excellent results in all cases.

Much experimental work has been done with insecticides. Nicotine sulphate has been studied with a view to its standardization for different insects. Flour paste has been discovered to be an excellent spreader of insecticide washes. Arsenite of zinc has been tested with good results against a variety of insects.

Much work has also been done with different insecticide distributors for use in truck fields. Because of the difficulty experienced with the heavy draft of horse-drawn vehicles using traction as power for the pump, experiments have been made with light high-speed gasoline engines. A horse-drawn sprayer of this type was devised, and it is doing effective work on Long Island. Another adaptation of this type of sprayer is in use at Garden City, Kans., and another one, self-propelled, will soon be available for use in the onion fields in Texas and Louisiana, where such a machine has long been a necessity for the control of the onion thrips.

INVESTIGATIONS OF INSECTS AFFECTING STORED PRODUCTS.

Work on stored-product insects, which include those affecting stored grain, flour, meal, prepared cereals, dried fruits, beans, peas, and other seeds, meats, cheese, fabrics, and other vegetable and animal matter kept in storage, has been continued, as in previous years, under the direction of Dr. F. H. Chittenden. Improved applications of the known remedies have been made, and new methods have been tried out. Insect-proof cartons for cereals and dried fruits have been invented, and methods of sterilization of mill products have been investigated. A publication on the insect-proof carton has been issued.

As a new project during the year, a preliminary examination has been made of Argentine corn, from the entomological standpoint, with especial reference to what is generally called in the trade "the Argentine corn weevil." This term proves to include several different species, mainly the rice weevil, or corn weevil of the South, the Angoumois grain moth, and the granary weevil, all of which are cosmopolitan insects and occur abundantly in different parts of the United States. The preliminary work consisted in the examination of the Argentine grain, the determination of the different species, and the study of conditions and methods, especially with regard to handling at the port of New York. Certain shipments from Argentina show a damage of from 20 to 30 per cent by the various weevils. One species has been found which may possibly be new to this country.

During the year practical experiments were made, on both small and large scales, in the use of gases or fumigants. Of these, dichlorbenzine was thoroughly tested against various stored-product insects, such as weevils, beetles, and moths, and against ants, cockroaches, and other household pests. This gas possesses the value of being neither inflammable nor explosive, so far as could be determined, and it is not injurious to man or domestic animals when inhaled. Various grains, seeds, etc., after fumigation with this substance, have been taken directly from the fumigating house and fed to domestic animals with no harmful results.

Additional observations on the practical use of hydrocyanic-acid gas have been made, and various facts have been ascertained which were previously unknown.

A heating machine, for the destruction of insects in beans, peas, and other seeds, has also been perfected.

INVESTIGATIONS OF TROPICAL AND SUBTROPICAL FRUIT INSECTS.

The investigation of insects injurious to tropical and subtropical fruits is under the direction of Mr. C. L. Marlatt.

Hydrocyanic-acid gas investigations.—The investigation of the use of hydrocyanic-acid gas for fumigating citrus trees in southern California during the season of 1913–14 has brought this work to practical completion in so far as the main problem is concerned, and a bulletin giving revised practical directions for such fumigation has been prepared and is ready for publication.

Certain citrus insects can not always be satisfactorily controlled by fumigation, and the field force hitherto charged with fumigation experiments has taken up the subject of the control of these and other citrus pests by spray methods as an alternative to the gassing process. The headquarters for this investigation were transferred July 1, 1914, from Whittier, Cal., to Pasadena, Cal.

The citrus white fly.—As indicated in the report for last year, the investigation of the citrus white fly in Florida is substantially completed. The educational work, in the way of orchard demonstrations in cooperation with growers in different sections of the State, is in progress.

Insects affecting date palms.—The investigation of insects affecting date palms, begun during the preceding year, is still in progress. The annual cycle and life history of the two principal date scale-insect pests will probably be well worked out and completed by the end of 1914, and will be the basis of future control methods.

Citrus insects in the Louisiana district.—The investigation of citrus insects, undertaken during the preceding year, is progressing very satisfactorily. The determination of practical means of control of the Argentine ant in the orchards of New Orleans has been the important work during the year, and it will be possible very soon to present a publication detailing these results.

Mediterranean fruit fly.—The investigation of the Mediterranean fruit fly in the Hawaiian Islands, and the control of fruits shipped from these islands to the mainland of the United States, is being conducted in cooperation with the Federal Horticultural Board. The life-history studies of the fruit fly in relation to its many host fruits is approaching completion, and two minor reports have been submitted for publication. Intimate cooperation is maintained with the Territorial board of agriculture of the Hawaiian Islands in the introduction and establishment of parasitic enemies. The quarantine and inspection of fruits is a continuing operation under the Hawaiian fruit fly quarantine. The local clean-up work in the city of Honolulu has been discontinued. The results gained did not warrant the expenditure, and the work operated as an obstacle to the successful introduction and multiplication of parasites.

WORK IN BEE CULTURE.

Dr. E. F. Phillips remains in charge of the work in apiculture.

Wintering of bees.—The principal work of the year is the continuation of the investigation of bees during the winter. This work, begun in September, 1912, was again carried on during the winter of 1913–14 in the zoological laboratory of the University of Pennsylvania at Philadelphia, Pa., where the bureau had the use of a constant-temperature room, which was used as the beekeeper in the North uses his special bee cellar or repository.

In the work of the year special attention was given to the reduction of heat production to the minimum so that the energies of the bees may be conserved. During the first winter (1912–13) the room was kept at about 43° F., the temperature which is usually considered by beekeepers as the best. Since the early results of this investigation showed that bees generate little heat at temperatures of 57° F. or slightly above, the room temperature was raised to about 57° F. in 1913–14. It was then found that, while heat production was for a time materially reduced, the relative humidity of the room was so decreased that the bees required additional water in some form. A series of experiments was then tried to overcome the harmful conditions due to too low a humidity, and it was found possible to keep the bees in good condition at the higher temperature by supplying moisture.

In the last annual report attention was called to the fact that under certain conditions no heat is produced by the bees and that at lower temperatures the production of heat begins. It has now been possible to formulate this law of heat production more definitely. The results of this part of the work were published during the year in Department Bulletin No. 93, in which it was stated that undisturbed broodless bees generate virtually no heat between 57° and 69° F., while when below the lower critical temperature they generate heat sometimes sufficiently to raise the cluster temperature almost to human blood heat. At higher temperatures the bees move about freely and regulate the temperature of the hive by other means. It

has also been shown that this heat is practically all produced by means of muscular activity. Since the length of life of the bee is determined by the amount of energy expended, it becomes necessary to reduce this muscular activity as much as possible.

A series of observations on colonies out of doors has been carried on for the last two winters, special attention being given to the effects of various kinds and methods of packing and other protection usually employed by beekeepers. It is found that the unprotected single-walled hive often used by beekeepers south of the fortieth degree of latitude and perhaps farther north offers virtually no protection from changes in external temperature during the winter, and that in such a hive an enormous amount of heat production is necessary during cold weather. The giving of additional packing has been found materially to reduce the amount of heat produced.

A special scale for taking weights of a single colony at frequent intervals has been devised for the bureau, and one was purchased in the fall of 1913. By means of this instrument it has been possible to get the hourly changes in weight of one of the colonies in the constant-temperature room. Data of this kind, together with data on the death rate of bees, will be used to determine the differences in the rate of food consumption at different temperatures, correlating these data with the temperature of the cluster. It is too early to give the detailed results of this work.

A general discussion of the winter problem, giving the results of the numerous previous investigations and observations, has been prepared for the purpose of giving beekeepers access to the results. This will be presented for publication in the near future.

The development of the bee.—The work on the development of the bee, which has been carried on for some time, has been entirely completed, and forms probably the most extensive study so far made on the embryology of any insect. The work includes a special study of the development of the nervous system, which helps to solve one of the most disputed points in insect embryology.

The activities of bees.—Continuing the policy of laying a firm foundation for practical manipulations of bees by a study of their sense organs and their functions, work on the olfactory sense has been continued. The results of the first part of this work were published in the Journal of Experimental Zoology in April, 1914, under the title "The olfactory sense of the honeybee." In brief, the conclusion is that the antennæ play no part in the perception of odors, as is usually believed by entomologists, but that certain pores, named olfactory pores, are the organs of odor perception. These are located on the legs, wings, and other parts of the body.

A study was also made of the dorsal scent gland of the bee, including its structure and function. The description of this organ will soon be published.

Diseases of bees.—The principal contribution to the investigation of bee diseases during the year is a paper on the amount of heat necessary to destroy the organisms known to be responsible for bee diseases.

Effect on bees of spraying fruit trees while in bloom.—Work on the important problem of the effect on bees of spraying fruit trees while in bloom was begun in the spring of 1914, in cooperation with the Deciduous Fruit Insect Investigations of this bureau. Some interesting results have been obtained and the work will be continued.

REPORT OF CHIEF OF BUREAU OF BIOLOGICAL SURVEY.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF BIOLOGICAL SURVEY,
Washington, D. C., September 10, 1914.

SIR: I have the honor to submit herewith a report on the work of the Biological Survey for the fiscal year ended June 30, 1914.

Respectfully,

HENRY W. HENSHAW,
Chief, Biological Survey.

Hon. DAVID F. HOUSTON,
Secretary of Agriculture.

WORK OF THE BIOLOGICAL SURVEY.

During the year the work of the Bureau of Biological Survey was conducted along four principal lines: (1) Investigations of the food habits of North American birds and mammals in relation to agriculture; (2) biological investigations with special reference to the geographic distribution of native animals and plants; (3) supervision of national bird and mammal reservations, the preservation of native wild game, and the enforcement of the Lacey Act; (4) administration of the Federal migratory bird law.

ECONOMIC INVESTIGATIONS.

PRAIRIE DOGS IN NATIONAL FORESTS.

Campaigns for the extermination of prairie dogs in National Forests were conducted during the year in the Pike and Cochetopa Forests in Colorado, the Coconino Forest in Arizona, and the La Sal and Sevier Forests in Utah. In the two Colorado Forests work will be completed early in the present fiscal year. As a result of the methods worked out by the bureau, prairie dogs have been completely exterminated over large areas where once they were common, and now only an occasional animal is seen in places where a year or two ago hundreds were in sight at one time. Following the destruction of a large proportion of the prairie dogs by poison, predatory birds and animals exterminated those remaining.

Experiments were made in the Sevier Forest in May, when two days' work resulted in clearing large areas to such an extent that in a careful reconnoissance a week later no dogs were seen or heard where before they were very numerous.

In the La Sal Forest preliminary work was started in the spring. Future work will consist mainly in exterminating scattering colonies throughout the valleys and bench lands along the streams.

BURROWING RODENTS ON RECLAMATION PROJECTS.

In the Strawberry Valley Project of the United States Reclamation Service, near Provo, Utah, burrowing animals have caused extensive washouts in dikes and fills. Reconnoissance work was begun there in the autumn, and during the spring active operations were carried on with such good results that it is believed little trouble from burrowing rodents will in future be experienced.

MOLES IN THE NORTHWEST.

In the States of Oregon and Washington moles are so numerous in certain sections that their burrows interfere materially with the cultivation of crops. Investigations are now being made with a view to the discovery of effective methods of dealing with the pests.

GROUND SQUIRRELS IN CALIFORNIA NATIONAL FORESTS.

Active campaigns of extermination were carried on during the year against ground squirrels in portions of the Monterey, Santa Barbara, San Benito, Kern, and Sequoia National Forests. The success of this work encouraged ranchmen and land owners adjoining the Forests to cooperate with the bureau and also to carry on independent campaigns to exterminate the animals on their holdings. As a consequence, on thousands of acres which once supported squirrels in abundance it is now difficult to find more than an occasional individual.

GROUND SQUIRRELS IN NORTH DAKOTA.

Though it is one of the smaller squirrels, the Richardson ground squirrel has become so destructive in North Dakota that State authorities have requested cooperation of the bureau for devising methods of control. As soon as the animal emerged from hibernation an assistant was detailed on the problem, and effective poisoned baits were successfully prepared.

RODENTS AS ENEMIES OF REFORESTATION.

One of the greatest hindrances in reforesting, either by reseeding or by planting nursery stock, is presented by the noxious rodents that follow in the wake of planters and dig up and devour seeds or gnaw the bark of saplings. Extermination of these rodents locally has been found absolutely necessary to successful reforestation.

During the winter, at the request of the Forest Service, experiments for the control of seed-eating rodents were carried on in the National Forest near Ocala, Fla., and at the Converse nursery in southern California. These have resulted in the collection of much useful information.

JACK RABBITS IN THE NORTHWEST.

During the year extensive damage was done by jack rabbits in southern Idaho and eastern Oregon and Washington, and many urgent requests for aid were received from the farmers of the region.

Three assistants were detailed to visit the infested sections and to demonstrate the efficacy of strychnine baits in reducing the numbers of the pest. These demonstrations were so successful that in one rather restricted region over 50,000 rabbits were destroyed. It is believed that by commencing the work as soon as winter sets in the ravages of these animals can be greatly reduced if not altogether controlled.

CRAWFISH IN MISSISSIPPI AND ALABAMA.

During the year experiments in destroying crawfish were conducted on two plantations near Muldon, Miss., and on one near Macon, in the same State. These experiments demonstrate that crawfish, a well-known pest of cotton and corn crops of this region, can be completely controlled by the use of carbon bisulphide. If the infested areas are treated after they are prepared for planting, and again after the seed is sown, the crawfish which escape are so few that they do little damage. At Muldon, where operations have been carried on for the last three years, a number of planters are following the methods recommended by the bureau.

FOOD OF WILD DUCKS.

The growing scarcity of waterfowl and the draining of many of their former feeding grounds for agricultural purposes have greatly stimulated efforts to increase their numbers under semidomestic conditions and to provide sustenance for both wild and propagated birds by growing in suitable places the plants which formed their favorite natural food. During the year a second bulletin on important wild-duck foods, Department Bulletin No. 58, was issued, and supplied on request to State game associations, game protective associations, and individuals interested in the practical protection, preservation, and propagation of native ducks and geese.

RELATION OF BIRDS TO THE BOLL WEEVIL.

In order to learn to what extent birds prey upon the boll weevil in newly infested territory, bird stomachs were collected during the last two field seasons in certain sections in Alabama and Mississippi. From a study of two-thirds of this material it is evident that birds find and prey upon the cotton boll weevil immediately upon or soon after its advent into a new region. The investigation has added 11 species to the list of known bird enemies of this pest, making a total of 64.

RELATION OF BIRDS TO THE ALFALFA WEEVIL.

All of the stomachs collected during the investigation of the relations of birds to the alfalfa weevil in Utah and adjacent States have been examined and a report upon the subject has been issued.

Forty-five species of birds, as well as frogs, toads, and a salamander, were found to feed on the beetle. The most active enemies of the weevil among birds are the Brewer blackbird, the western meadowlark, the valley quail, and the English sparrow. Of vertebrate enemies other than birds, the Rocky Mountain toad renders good service

in destroying breeding adult insects in the spring and larvæ later in the year, when the alfalfa crop is being harvested. These valuable batrachians should therefore be carefully protected in the infested districts and their numbers should be increased so far as possible.

RELATION OF BIRDS TO THE RANGE CATERPILLAR.

During the summer of 1913 an assistant of the Biological Survey collected stomachs of about 600 birds and 100 mammals in a part of New Mexico badly infested by the destructive range caterpillar. About five-sixths of this collection have now been examined. The results seem to prove that birds are of no value as enemies of the full-grown caterpillars; it remains to be seen whether they are of greater importance during the early stages of the life of the insect. Mammals, on the other hand, as indicated from the evidence collected, are important enemies of this pest. This is particularly true of the skunk.

ECONOMIC STATUS OF OTHER BIRDS.

Examination of the collection of stomachs of thrashers, mocking birds, and wrens was largely completed, and investigation of the economic status of the crow and English sparrow progresses steadily. As the collection of stomachs of the last-named species is much larger than that upon which the original printed reports were based and represents a much greater extent of country, it is expected that the conclusions derived from the present work will have a more permanent value.

EUROPEAN STARLING.

For several years the bureau has been accumulating data on the food and general habits of the European starling for the purpose of determining the economic status of the species in this country. Introduced into the United States nearly 25 years ago, the bird has gradually extended its range from New York City, and now it is found in the neighboring States of Connecticut, New Jersey, New York, Pennsylvania, and Massachusetts. During its migrations in search of food it ranges much farther from the original center and occurs in considerable numbers as far south even as the District of Columbia.

The starling is markedly insectivorous, especially in summer, and preys upon many noxious varieties. In this respect it is to be classed among our useful birds. So far as is known, it has not proved destructive to grain crops, but it is known to be very fond of small fruits, and as it associates in large flocks it is likely to become a pest to the orchardist. In addition, it prefers tree cavities, boxes, or recesses in buildings for nesting sites and thus is brought into direct competition with certain of the useful native birds, more particularly the bluebird, purple martin, white-bellied swallow, house wren, and flicker.

The bird is steadily extending its territory, and it will be wise to withdraw all protection from it, as has already been done in Connecticut, New Jersey, New York, and Pennsylvania, including the center of its abundance, with a view of checking its increase and spread. The shipment of these birds from one State to another has been prohibited under heavy penalty by act of Congress. Under

ordinary circumstances, even after all protection is withdrawn, the bird will probably prove to be capable of taking care of itelf. That ultimately it will spread over a large part of the United States is highly probable.

BIRDS OF PORTO RICO.

An investigation of the birds of Porto Rico was made in 1912–13 at the request of and in cooperation with the Board of Commissioners of Agriculture of the island. Examination of the stomachs of birds collected has now been completed, and a report of their habits and economic relationships is practically ready for publication.

BIRDS OF PANAMA.

An assistant of this bureau participated in the biological survey of the Canal Zone made under the direction of the Smithsonian Institution, and in the course of his work preserved the stomachs of a considerable number of birds. Examination of these stomachs has been begun with a view of ascertaining the economic relations of birds inhabiting the zone, especially the extent to which they destroy disease-carrying insects like mosquitoes.

FUR-BEARING ANIMALS.

Up to the present time experiments in breeding fur bearers have been carried on only with minks and martens. At the two stations—Prichard, Idaho, and the National Zoological Park—minks have bred, and the healthy condition of the young animals promises success. The stock of martens was secured too late for the animals to breed this season. In the coming year it is intended to add raccoons, skunks, and possibly foxes to the list of animals to be included in these experiments.

During the spring an assistant visited New Brunswick, Prince Edward Island, and other portions of the eastern British Provinces and New England for the purpose of studying the methods in vogue in the region for rearing foxes and other fur bearers. Data on improved methods of raising foxes will soon be published, to bring up to date preliminary information furnished in 1908 in Farmers' Bulletin 328, Silver Fox Farming.

Moleskins have been extensively used in this country during the last few years in making fur garments, and practically all of the supply has been imported from Europe. In the belief that the common mole of eastern United States produces fur of equal value, skins were submitted to professional furriers, who stated that the quality is superior to the foreign product. A report on the economic status of the eastern species was published during the year. The mole inhabiting the northwestern coast is larger than the common eastern species, and a number of these have been collected in order to obtain a report on the quality of the pelt. If the texture of the fur proves to be as good as that of the eastern animal, there is no reason why trappers should not secure a good income by capturing these animals, as the area they inhabit is extensive. In many localities an acre of ground supports as many as a hundred individuals. If this little animal can be profitably trapped for its fur the problem of freeing agricultural areas from it will practically be solved.

Investigations into the economic value of North American skunks resulted in the publication of a Farmers' Bulletin on the subject. It has been found that this animal is one of the most useful of native mammals and a most efficient help to the farmer and the orchardist in their warfare against insect and rodent pests. As a source of fur it is also a commercial asset, the skins netting trappers about $3,000,000 annually. As the skunk is valuable in its activities as well as for its fur, experiments in breeding the animals in captivity are recommended.

METHODS OF ATTRACTING BIRDS.

During the last winter an assistant visited the principal herbaria of New York and New England for the purpose of gathering information on the ripening seasons of fruits which supply food for birds. A large amount of valuable data was obtained for use in a publication, now in press, on methods of attracting birds in northeastern United States, for which information there is great demand.

The bureau is also preparing a publication on the construction of nesting boxes for insect-eating birds, which will soon be ready for distribution as a Farmers' Bulletin.

BIOLOGICAL INVESTIGATIONS.

Field investigations of the distribution and habits of native birds and mammals have continued throughout the year. Good progress has been made in collating and arranging under a card-index system the vast number of manuscript notes which have been accumulating during the years of field work of the bureau. In the near future all of this information will be fully indexed and more readily available for reference in connection with the administration of the Lacey Act and the migratory bird law, game preservation and economic investigations of this bureau, and to supply data constantly requested by individuals and institutions throughout the United States.

DISTRIBUTION MAPS OF BIRDS AND MAMMALS.

The preparation of maps showing in detail the distribution of each species of native birds and mammals has been continued. The work has already demonstrated its usefulness, both in ascertaining the economic relations of the several species and in planning for their conservation. A set of specimen distribution maps of important birds and mammals is nearly completed for the United States Government exhibit at the Panama-Pacific International Exposition to be held at San Francisco.

DISTRIBUTION MAPS OF NOXIOUS ANIMALS.

It is planned to secure accurate information concerning the location and extent of territory infested by various animal pests to serve as a basis for campaigns for their destruction. Mapping of the area occupied by prairie dogs in northeastern Arizona was begun in the spring of 1914 and is progressing rapidly. Farmers and stock growers throughout this region are taking much interest in the work and express a general desire to cooperate in the destruction of these animals.

BIRD MIGRATION.

In gathering first-hand observations on the migrations of birds, this bureau is aided by some 250 volunteer observers, located in different sections of the country. This cooperative work is of great assistance in platting migrations of species, and it is hoped to extend it. The resulting information is of much value, as shown by the fact that the data made possible the prompt formulation of regulations for administering the Federal migratory bird law. Much work, however, still is needed before the knowledge of the migratory movements of the many species of birds in this country will be complete.

BIRD CENSUS.

A plan for securing a census of the birds breeding within the United States was prepared and notices distributed among correspondents of the bureau early in the spring. The plan contemplated that each area selected should be located by definite boundaries in order that a similar annual census might be taken on the same area through a series of years for the purpose of learning what fluctuations, if any, occur in bird life, and of having a check on any changes due to the increase or decrease of species locally.

A considerable number of volunteer observers have taken up this work and many excellent reports already have been received. The results promise information of great practical value in connection with bird conservation.

BIOLOGICAL SURVEYS.

During the year the biological survey of Oregon was begun in cooperation with local institutions and is being pushed vigorously. The cooperative biological survey of North Dakota and the surveys of Alabama and Arizona were continued, and a small amount of work was done in a few other States. The cooperating institutions in Oregon have shown great interest in the survey and are expending much more money on the work than is this bureau. This cooperation follows plans formulated by the bureau, and all the information secured is to be available for publication by the department. This is also the case in North Dakota, where a similar lively interest in and appreciation of the value of the work is being shown by State institutions. A preliminary bulletin on the economic relations of the mammals of North Dakota to agriculture has been prepared and will be published by the State agricultural college. Field work on the biological survey of Wyoming has been completed and arrangements made for the preparation of the final report on the physiography and life zones of that State.

DISTRIBUTION AND HABITS OF LARGE GAME.

Considerable additions during the year have been made to the knowledge of the distribution and habits of the large game animals of North America. Owing to the decrease of these animals, it is necessary to secure accurate information concerning their present habitat and numbers with a view of preventing the extinction of the

species. The bureau has been fortunate during this year in the active cooperation of a number of men interested in the conservation of large game. Under the direction of the bureau, these men have expended time and money in conducting field investigations in the United States, Alaska, and various parts of Canada, the information and material obtained for study having become the property of the department.

TECHNICAL INVESTIGATIONS.

The Biological Survey is becoming a recognized center of information concerning the birds and mammals of North America, and individuals and institutions send in large numbers of specimens to be identified. State and county officials also forward skins and scalps offered for bounty to insure correct identifications in order to prevent fraud. In addition, specimens of noxious mammals are frequently forwarded for identification and advice as to proper methods of protection of crops. Technical study also has been made during the year of a number of groups of birds and mammals which were insufficiently known.

GAME PRESERVATION.

ENFORCEMENT OF THE FEDERAL MIGRATORY BIRD LAW.

The Federal migratory bird law (37 Stat., 847), approved March 4, 1913, authorized the department to prescribe suitable regulations for fixing close seasons on migratory game and insectivorous birds, and the Biological Survey was charged with carrying into effect its provisions. On June 17, 1913, proposed regulations as drafted by a committee of the bureau appointed for that purpose were approved by the Acting Secretary of Agriculture and published June 23. During the three months required by law for their consideration, public hearings were held in Omaha, Nebr.; Boston, Mass.; Trenton, N. J.; New Orleans, La.; and Washington, D. C. After amendments, the regulations were finally approved by the Secretary of Agriculture on September 27, 1913, and on October 1 were promulgated by the President, becoming effective at once. They were immediately given wide publicity and every effort was made to advise sportsmen and others as to the close seasons established.

As the appropriation for enforcement of the law was but $10,000, only seven field inspectors were appointed, but through cooperation with the various State game commissioners, 172 game wardens of various States were placed on the rolls of the department as Federal wardens at a nominal salary.

While the limited number of field men available for investigations and for making arrests for violations of the law were unable to accomplish all that could be desired, a large part of their time was devoted to educational work with a view to familiarizing the public with the regulations and the purposes of the law.

There has been little active opposition to the enforcement of the regulations, but the death of one warden in the performance of duty near Tappan Borough, N. J., on October 23, has to be reported.

While the regulations have met with some criticism by sportsmen in a few States, they have been indorsed by the majority of bird

conservationists and sportsmen of the country, as well as by leading journals, as the most important step ever taken in the conservation of bird life in this country.

Reports from various sections confirm the assertion that if migratory game birds are not disturbed in their spring flight a large increase in their numbers will follow. Already migratory waterfowl have been reported as nesting in sections of the country where for many years they have been absent during the breeding season.

NATIONAL BIRD RESERVATIONS.

Two national bird reservations have been established by Executive order during the past year—Anaho Island, in northwestern Nevada, and Smith Island, in Washington—making to date a total of 65 reservations.

Conditions on most of the important bird reservations during the past year have been favorable.

Forrester Island, Alaska.—At this reservation the bureau maintained regular warden service as in former years, during the fishing season, to prevent disturbance of bird life. Cooperation here between the Bureau of Fisheries and the National Association of Audubon Societies resulted in the first investigation of the economic relations of various species of birds on the island, with particular reference to their feeding on fish. It is understood that a report on the subject will be published by the Bureau of Fisheries.

Mosquito Inlet, Fla.—An experiment in feeding waterfowl at this reservation was made early in the spring in an endeavor to induce birds to remain on the reservation where they would be undisturbed. A quantity of shelled corn and other food was placed in the water by the warden, and while the experiment was not carried far enough to fully determine its efficacy, the reports indicate that feeding earlier in the season and on a larger scale will probably prove successful.

Niobrara, Nebr.—On this reservation 24 Chinese ring-neck pheasants were placed, which were obtained from the Oregon fish and game commission; and 12 Canadian wild geese secured in the vicinity of Charleston, Mo., where the birds are raised chiefly for live decoys.

Pelican Island, Fla.—An extraordinary phenomenon on the Pelican Island Reservation, following an unusually early nesting, was the desertion of young birds by their parents before they were able to care for themselves. Investigations failed to give a satisfactory solution of the cause of this singular action upon the part of the parent birds. Pelicans are usually devoted parents.

A novel and important feature in connection with reservations has been the taking of moving pictures of bird life. Permits to "hunt with the camera" are granted only after eggs have hatched, and operators are allowed to work only when accompanied by a warden, in order that the birds may not be unduly disturbed. The three reservations visited for this purpose were Malheur Lake and Klamath Lake, Oreg., and Clear Lake, Cal.

NATIONAL BISON RANGE.

With an addition of 19 calves born to the herd of buffalo on the National Bison Range during the past year, the total number of the

herd is now 115. It is difficult to ascertain the number of elk on the range, but 25 head have been observed by the warden in charge, an increase of 1 over last year. There were 9 antelope on the range at the end of the fiscal year, but the number of young born in the past spring is not yet known. No animals have died during the year.

Weather conditions during the spring were ideal, and an abundance of bunch grass and other feed was the result. Many improvements have been made, roads have been repaired, trails cleared, and a telephone line 2 miles long constructed to connect with the Flathead Co.'s lines.

ELK REFUGE IN WYOMING.

Negotiations have been practically consummated for the purchase of a tract of land for a winter elk refuge in Jackson Hole, Wyo., authorized by act of March 4, 1913 (37 Stat., 828), but title to the land has not yet been secured.

NIOBRARA GAME RESERVATION.

Conditions on the Niobrara Reservation have been exceptionally favorable, and all the animals are in good condition. The reservation continues to be an attraction to citizens of the State, as is evidenced by the large number of visitors. The 37 animals now on the reservation include 10 buffalo, 23 elk, and 4 deer. Since their arrival there has been an increase of 2 buffalo, 7 elk, and 1 deer. The only loss so far reported was that of a young elk, which died during the winter. The additional deer was purchased from the park department of Council Bluffs, Iowa.

WIND CAVE GAME PRESERVE.

Through cooperation of the American Bison Society, 14 buffalo, 7 males and 7 females, donated by the New York Zoological Park, were successfully shipped by express on November 25 to the Wind Cave Preserve, near Hot Springs, S. Dak. Sufficient land has been acquired and added to the preserve to insure a permanent water supply. With the 21 elk transferred from Jackson Hole, Wyo., and a deer recently purchased, there are now 36 animals on the preserve. Contracts have been let for the construction of a strong woven-wire fence, 88 inches in height and 8.67 miles in length, to inclose 4,160 acres of the preserve.

FEEDING AND TRANSPORTING ELK.

Owing to the unusually mild winter in the Jackson Hole region in Wyoming, and a fall of snow below the normal, the migration of elk to the feeding grounds was not large. Feeding of elk began January 30 and continued until March 28, during which time about 550 tons of hay were used and a total of 6,150 elk fed. The loss of elk at the feeding grounds was normal.

Only 241 elk were captured in Jackson Hole, 84 by the game authorities of Wyoming for distribution in that State and 157 by the Biological Survey for distribution to National and State game reservations, all being hauled to Victor, Idaho, for shipment. The first

shipment under the supervision of this bureau was made March 10 and consisted of 50 head for distribution in the National Forests in Colorado. The next shipment of 46 was made March 13 for distribution in the National Forests in Utah. On March 23 a shipment of 23 elk was made to the newly created State preserve in Custer County, S. Dak., and on the same date an agent of the bureau shipped 21 head to the Wind Cave Game Preserve near Hot Springs, S. Dak. All of these shipments, some by freight and some by express, were made without loss.

Reports indicate that there were but slight winter losses among the elk not fed, owing to the absence of severe snowstorms. No census of elk was made this year in the Jackson Hole region, as the mild weather conditions prevented an accurate count of the widely scattered animals, but there is reason to believe there has been a substantial increase in the herd.

TRANSFER OF REINDEER IN ALASKA.

Through cooperation with the Departments of the Interior and the Treasury, the project of stocking with reindeer a part of the Aleutian Islands Reservation was carried out under the supervision of Commodore G. R. Salisbury, United States Navy, retired. It was planned to transfer a number of reindeer from Ugashik, on the Alaska Peninsula, to the reservation, one-half to be placed on Attu Island and the remainder on Umnak Island. On September 8 the revenue cutter *Manning* left Portage Bay with 65 reindeer aboard. Very rough weather was experienced and in consequence many of the animals refused to eat, 8 of them dying. In was therefore decided to place a herd of 21 on Dutch Harbor Island instead of Attu, and to land the remainder, 36 head, at Umnak. Seventeen of the 21 reindeer landed on Dutch Harbor were observed by the native herder in charge on April 22, but no report has been received concerning the condition and number of the herd left at Umnak, as no herder could be stationed there.

IMPORTATION OF BIRDS AND MAMMALS.

In supervising the importation of birds and mammals inspectors are maintained at New York, Philadelphia, and San Francisco. During the year 529 permits were issued, an increase of 38 over 1913, and 211 inspections were made as against 179 in 1913. In all 475,392 birds and 10,602 mammals were imported under permit. Among these were 368,676 canaries, 36,760 partridges, 4,148 pheasants, 2,940 miscellaneous game birds, and 62,868 miscellaneous nongame birds.

At Honolulu 50 permits were issued for the entry of 745 birds, principally pheasants.

There was a noticable increase in the importation of partridges, as a number of States, including Iowa and Oregon, are experimenting in the introduction of these game birds for restocking purposes.

No Mexican quail were imported during the year. Permits were not issued at any port along the Mexican border, as it was necessary to prevent diseased birds from being admitted, no inspection service being maintained there. The issuance of permits for Mexican quail will probably be resumed during the winter months at Brownsville,

Tex., when danger of disease is at a minimum. The birds will be kept there in quarantine for at least 10 days before being shipped north.

A decided increased importation of foxes from Canada was noticeable, in most instances for breeding purposes.

No prohibited species were presented for admission, and so far as is known none gained entry during the year.

INTERSTATE COMMERCE IN GAME.

Enforcement of sections 242, 243, and 244 of the Criminal Code, known as the Lacey Act, relating to interstate traffic in game, resulted in the investigation of over 400 cases, of which there are 74 still pending. About 180 cases were reported during the year involving violations of law in the States of Delaware, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Michigan, Minnesota, New York, North Carolina, Ohio, Tennessee, Virginia, West Virginia, and Wisconsin, and in the District of Columbia, two-thirds of the cases being from the States of Kentucky, Tennessee, and Virginia.

The pending cases involve interstate shipments of over 25,000 quail, about 1,500 partridges, nearly 1,700 pheasants, and more than 250 miscellaneous game birds. The cases under investigation are concerned with shipments of about 18,500 quail, more than 8,000 reedbirds, and about 2,000 other game birds. The cases disposed of involved the illegal shipping of more than 49,000 quail, over 5,000 partridges, and about 1,700 pheasants.

The bureau has continued in every possible way to assist State authorities in putting a stop to illegal shipments of game.

PUBLICATIONS.

The publications of the bureau during the year have included two North American Faunas, two Department Bulletins, two Farmers' Bulletins, and various circulars and announcements.

Reports relating to general work on birds and mammals nearly completed or in process of preparation include North American Faunas on Birds of Porto Rico, Birds of Texas, and Revisions of North American Marmots, and of North American Moles; Department Bulletins on Birds in Relation to the Alfalfa Weevil, and Distribution and Migration of North American Rails and Their Allies; and Farmers' Bulletins on Bird Houses, Bird Attraction, and Pocket Gophers.

REPORT OF THE CHIEF OF THE DIVISION OF ACCOUNTS AND DISBURSEMENTS.

UNITED STATES DEPARTMENT OF AGRICULTURE,
DIVISION OF ACCOUNTS AND DISBURSEMENTS,
Washington, D. C., September 24, 1914.

SIR: I have the honor to submit herewith a report of the work of the Division of Accounts and Disbursements for the fiscal year ended June 30, 1914.

Respectfully,

A. ZAPPONE,
Chief of Division.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

CHARACTER OF WORK.

The chief of the division and disbursing clerk is charged by the Secretary of Agriculture with the duty of preparing all requisitions for the advance of public funds from the appropriations for the Department of Agriculture to disbursing clerks and special disbursing agents charged with the disbursement of public funds; the keeping of appropriations ledgers relating to the advance and disbursement of all items of appropriations; and the payment of all vouchers and accounts submitted from the various offices, bureaus, and services of the department. He performs such other duties as may be prescribed by the Secretary.

WORK OF THE YEAR.

APPROPRIATIONS, EXPENDITURES, ETC.

The total appropriations for the department for the year ended June 30, 1914, including unexpended balances of continuous appropriations brought forward from the previous year, amounted to $30,212,832.64, of which sum $22,532,285.39 was disbursed prior to the close of the year, leaving a balance of $7,680,547.25, which is nearly all covered by outstanding liabilities. Supplemental accounts for the year 1913 were also paid, amounting to $1,971,959.83.

The unexpended balances for the year 1912, amounting to $1,417,601.14, were finally covered into the Treasury on June 30, 1914, to the "Surplus Fund."

There were received, examined, and paid by this office 95,900 accounts, which required the issuance of 168,465 checks on the Treasurer of the United States.

There were also sent to the Treasury Department for payment 2,737 accounts.

LOST CHECKS.

During the year 92 checks were lost in transit through the mails or by the payees, and were duplicated by this office.

PUBLIC MONEYS RECEIVED FROM VARIOUS SOURCES.

There were received from various sources and deposited in the Treasury to the credit of the proper funds the following sums:

Miscellaneous receipts, sales of condemned property, etc	$42,165.63
Sales of products, agricultural station, Hawaii	448.02
Sales of products, agricultural station, Porto Rico	1,391.37
Sales of products, agricultural station, Alaska	6,323.53
Sales of products, agricultural station, Guam	233.47
Total	50,562.02

STATEMENT OF APPROPRIATIONS, DISBURSEMENTS, AND UNEXPENDED BALANCES FOR THE UNITED STATES DEPARTMENT OF AGRICULTURE.

Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
1839..	$1,000.00	$1,000.00	.....	1878..	$198,640.00	$197,634.94	$1,005.06
1840..	.....	.....	.....	1879..	206,400.00	206,360.00	40.00
1841..	.....	.....	.....	1880..	199,500.00	198,361.72	1,138.28
1842..	1,000.00	1,000.00	.....	1881..	275,460.31	267,608.84	[1] 7,851.47
1843..	.....	.....	.....	1882..	363,011.05	354,482.39	[2] 8,528.66
1844..	2,000.00	2,000.00	.....	1883..	456,396.11	438,941.72	[3] 17,454.39
1845..	2,000.00	2,000.00	.....	1884..	[4] 416,641.10	413,618.09	3,023.04
1846..	3,000.00	3,000.00	.....	1885..	[4] 655,930.25	558,934.89	[5] 96,995.36
1847..	3,000.00	3,000.00	.....	1886..	[4] 677,973.22	519,196.11	158,777.11
1848..	4,500.00	4,500.00	.....	1887..	[4] 657,641.81	628,287.14	29,354.67
1849..	3,500.00	3,500.00	.....	1888[6]..	1,027,219.06	1,011,282.62	15,936.44
1850..	5,500.00	5,500.00	.....	1889..	[4] 1,134,480.60	1,033,590.22	[7] 100,890.38
1851..	5,500.00	5,500.00	.....	1890..	[4] 1,170,139.11	971,823.62	[8] 198,315.49
1852..	5,000.00	5,000.00	.....	1891..	[4] 1,372,049.21	1,266,277.36	105,771.85
1853..	5,000.00	5,000.00	.....	1892..	[4] 2,303,655.75	2,253,262.29	50,393.46
1854..	10,000.00	10,000.00	.....	1893..	2,540,060.72	2,355,430.25	184,630.47
1855..	[4] 50,000.00	50,000.00	.....	1894..	2,603,855.58	1,977,469.28	[9] 626,386.30
1856..	30,000.00	30,000.00	.....	1895..	[9] 2,506,915.00	2,021,030.38	485,884.62
1857..	75,000.00	75,000.00	.....	1896..	2,584,013.22	2,094,916.42	489,096.80
1858..	63,500.00	63,157.25	$342.75	1897..	2,448,763.53	2,348,512.98	100,250.55
1859..	60,000.00	60,000.00	.....	1898..	2,467,902.00	2,425,510.44	42,391.56
1860..	40,000.00	40,000.00	.....	1899..	2,829,702.00	2,827,795.65	28,899.27
1861..	60,000.00	60,000.00	.....	1900..	3,006,022.00	2,947,603.42	58,418.58
1862..	64,000.00	63,704.21	295.79	1901..	3,304,265.97	3,239,137.39	65,128.58
1863..	80,000.00	80,000.00	.....	1902..	3,922,780.51	3,902,675.79	20,104.72
1864..	199,770.00	189,270.00	10,500.00	1903..	5,015,846.00	4,734,230.84	281,615.16
1865..	112,304.05	112,196.55	107.50	1904..	5,025,024.01	4,969,311.64	55,712.37
1866..	167,787.82	167,787.82	.....	1905..	5,894,540.00	5,820,204.00	74,336.00
1867..	199,100.00	199,100.00	.....	1906..	6,225,690.00	6,029,510.02	196,179.98
1868..	279,020.00	277,094.34	1,925.66	1907..	9,505,484.74	9,025,318.93	1,200,165.81
1869..	172,593.00	172,593.00	.....	1908..	11,487,950.82	11,045,412.19	442,538.63
1870..	156,440.00	151,596.93	4,843.07	1909..	15,385,806.00	15,079,472.29	306,333.71
1871..	[4] 188,180.00	186,876.81	1,303.19	1910..	15,958,811.27	15,547,983.00	410,828.27
1872..	197,070.00	195,977.25	1,092.75	1911..	17,278,976.10	16,814,726.93	464,249.17
1873..	202,440.00	201,321.22	1,118.78	1912..	[10] 23,090,842.15	21,673,241.01	1,417,601.14
1874..	257,690.00	233,765.78	23,924.22	1913 [11]	[10] 24,735,135.80	18,301,453.09	6,433,682.71
1875..	337,380.00	321,079.83	16,300.17	1914 [11]	[10] 30,212,832.64	22,532,285.39	7,680,547.25
1876..	249,120.00	198,843.64	50,276.36				
1877..	194,686.96	188,206.19	6,480.77	Total	[12]211,944,240.10	[13]190,098,276.56	[14] 21,651,725.90

[1] Includes $1,646.45 of the appropriation for reclamation of arid lands, carried to the fiscal year 1882.
[2] Includes $85.26 of the appropriation for reclamation of arid lands and $3,530.85 of the appropriation for experiments in the manufacture of sugar, carried to the fiscal year 1883.
[3] Includes $7,656.13 of the appropriation for reclamation of arid lands, carried to the fiscal year 1884.
[4] Including deficiency appropriation.
[5] Includes $93,192.27 of the appropriation for Bureau of Animal Industry and $2,970.82 of the appropriation for quarantine stations, carried to the fiscal year 1886.
[6] For the fiscal year 1888, including the sum of $8,000 appropriated for deficiencies in the appropriation for experiments in the manufacture of sugar for the fiscal years 1887 and 1888, of which $7,927.50 was disbursed and $72.50 remained unexpended.
[7] Includes $12,923.25 of the appropriation for botanical investigations and $58,364.76 of the appropriation for experiments in the manufacture of sugar, carried to the fiscal year 1890.
[8] Includes $188,974.69 of the appropriation for Bureau of Animal Industry, carried to the fiscal year 1891.
[9] Includes $7,891.94 for statutory salaries of the year 1894.
[10] The figures under "Amount appropriated" for the fiscal years 1912, 1913, and 1914 represent the agricultural bill, permanent annual appropriations, deficiency acts, special acts, and also unexpended balances carried forward from previous years.
[11] For the years 1913 and 1914 the figures given represent payments made to close of June 30, 1914, the accounts for those years being still open at the date of this revision.
[12] This total is the amount actually appropriated for the various fiscal years, with the exception of $37,604.70 appropriated July 13, 1868, to cover a number of expenditures made in previous years. It does not include an aggregate sum of $369,344.48 reappropriated from the unexpended balances of several fiscal years. (See foregoing notes.)
[13] Does not include $37,604.70 which was disbursed during several years and covered by an appropriation of like amount made July 13, 1868. (See note 12.)
[14] Does not include an aggregate sum of $369,344.48 reappropriated from the unexpended balances of several fiscal years. (See foregoing notes.)

REPORT OF THE EDITOR.

UNITED STATES DEPARTMENT OF AGRICULTURE,
DIVISION OF PUBLICATIONS,
Washington, D. C., September 1, 1914.

SIR: I have the honor to submit herewith the report of the operations of the Division of Publications for the fiscal year ended June 30, 1914.

Respectfully,

JOS. A. ARNOLD,
Editor and Chief.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

SUMMARY.

During the year just closed 1,152 new numbered bulletins, pamphlets, circulars, and reports of all kinds were issued by the department, the total number of printed copies aggregating 26,691,692. There were issued through the Division of Publications 1,056 new documents and 96 were issued by the Weather Bureau.

The total output of documents of all kinds, new and reprinted, amounted to 38,186,392 copies, of which 11,494,700 were reprints. The miscellaneous publications contributed by the various bureaus, divisions, and offices numbered 23,226,392 copies, while there were 14,960,000 copies of Farmers' Bulletins printed. Of the miscellaneous publications, 21,961,692 copies were new and 1,264,700 reprints. The amount expended for periodical publications was $60,655.51. The amount expended for administrative blanks, blank books, forms, etc., was $110,313.97. The amount expended for publications the printing of which is authorized by Congress was $82,201.20.

As usual, a considerable amount of work could not be completed and delivered by the Government Printing Office before the close of the year. Hence, the total amount of charges on such work is carried to the fiscal year 1915, and amounts to $42,189.56 on account of the general printing fund, and $16,484.22 on account of the Farmers' Bulletins. There was, however, no accumulation of manuscripts as last year. The amount of such charges for each bureau, division, and office carried to the next year is shown in the following table:

Expenditures for printing and binding for the fiscal year ended June 30, 1914, and estimated cost of work ordered but not finished.

Bureau.	Bills.	Estimates (carried to 1915).	Total.
Division of Accounts and Disbursements	$2,830.24	$207.45	$3,037.69
Bureau of Animal Industry	25,559.26	3,833.75	29,393.01
Bureau of Biological Survey	6,135.13	486.09	6,621.22
Bureau of Chemistry	16,913.63	575.51	17,489.14
Bureau of Entomology	7,093.45	1,487.75	8,581.20
Office of Experiment Stations	34,735.07	2,965.83	37,700.90
Forest Service	24,357.30	2,103.64	26,460.94
Library	11,345.84	663.25	12,009.09
Bureau of Plant Industry	33,791.10	3,681.17	37,472.27
Office of Public Roads	2,780.49	194.70	2,975.19
Division of Publications	12,508.96	819.44	13,328.40
Miscellaneous (Secretary)	66,231.93	6,701.33	72,933.26
Bureau of Soils	47,320.98	16,884.75	64,205.73
Bureau of Statistics	9,734.71	1,357.43	11,092.14
Federal Horticultural Board	814.53	150.25	964.78
Insecticide and Fungicide Board	1,568.01	47.20	1,615.21
Office of Markets	1,615.43	30.02	1,645.45
Total	305,336.06	42,189.56	347,525.62
Farmers' Bulletins	136,854.75	16,484.22	153,338.97

The number of employees in the division was 170. The department's allotment of the appropriation for printing and binding, including that for the Weather Bureau, was $490,000; the appropriation for salaries was $166,410, and that for miscellaneous expenses of the division $18,250.

The actual expenditures under the supervision of this division were as follows:

Printing and binding	$442,190.81
Salaries of employees (all on statutory roll)	164,586.48
Miscellaneous expenses, materials, supplies, etc	17,724.44
Total	624,501.73

For the purpose of comparison, the following statement of appropriations under the supervision of this division for the five fiscal years ended June 30, 1910, 1911, 1912, 1913, and 1914, is given:

Appropriations.	1910	1911	1912	1913	1914
Statutory roll of the division	$173,450	$172,730	$179,960	$194,700	$166,410
General printing fund (excluding Weather Bureau)	435,000	435,000	423,000	428,000	443,000
General expenses of the division	33,000	30,000	30,000	25,000	18,250
Total	641,450	637,730	632,960	647,700	627,660

RECLASSIFICATION OF DEPARTMENT PUBLICATIONS.

The most important new feature of the work of the year was the reclassification of the department publications, which became effective in July, 1913. Under this plan the bureau series of bulletins and circulars were discontinued and a new series of Department Bulletins was established, beginning with No. 1. Under this classification the 40 or more series of publications heretofore existing have been reduced to 4, as follows: (1) Department Bulletins; (2) periodical publications; (3) annual reports; (4) Farmers' Bulletins.

The popular and semitechnical matter heretofore published in the bulletins of the various bureaus has during the year been published as contributions from bureaus, divisions, and offices to the departmental series of bulletins. The series of circulars heretofore issued by the bureaus were discontinued. It was thought advisable during the year to establish in the department series a subseries, designated "Professional Papers," for contributions that are too technical for general distribution, but well adapted for dissemination to trades and industries.

There was established an additional periodical publication, entitled the "Journal of Agricultural Research," which has contained only reports of researches which were new and directly or indirectly useful to the art of agriculture. This Journal is edited by a committee which has consisted of Dr. Karl F. Kellerman, chairman, Dr. Edwin W. Allen, and Dr. Charles L. Marlatt. The Journal is distributed free only to the libraries of agricultural colleges and experiment stations, to large universities, technical schools, and such institutions as make suitable exchange with the department.

The Journal is royal octavo in size, giving greater freedom in the use of diagrams and technical illustrations, and separates of the different articles appearing in the Journal are printed and available for distribution at the time the number of the Journal containing them appears.

The contributors to this Journal have been members of the official scientific staff of the department, but it is proposed to broaden the number of contributors and include scientific workers of the State agricultural experiment stations, and when this is done the editorial committee will be increased by three additional members, selected from the staff of the agricultural experiment stations.

The character of the annual reports was materially changed, being confined to brief statements of the work actually accomplished, and their size reduced at least 50 per cent, thus effecting a considerable saving.

The character of the Farmers' Bulletins was also modified, with the view of restricting them to special instructions; in other words, to tell the people how to do things, and that in a limited space and in concise form, comprising generally not more than 16 or 20 pages each.

The Crop Reporter was discontinued, and a survey of the agricultural outlook, containing one or more brief articles of general interest and reports relative to acreage, production, value of farm crops, and value of farm animals, was issued monthly under the title of Agricultural Outlook in the Farmers' Bulletin series. The statistics formerly contained in the Crop Reporter are published in the Outlook. This bulletin has generally appeared about the first of each month, and was put in the Farmers' Bulletin series so as to make it available for distribution through Senators, Representatives, and Delegates in Congress, some of whom have placed orders for the regular distribution of the bulletins, as issued, to certain of their constituents.

The character of the Yearbook of the Department of Agriculture has been materially altered, as has also the typography and form; the articles have a popular character and are of the magazine

style. The volume for 1913 contained only 541 pages, as compared with 784 pages the preceding year.

Reprinting of the old bulletins of the various bureaus, divisions, and offices was discontinued except in rare instances, and the editions of the new series of Department Bulletins were considerably increased, so as to avoid reprinting, the intention being to expend the appropriation for new bulletins, and when the original edition becomes exhausted to refer applicants to the Superintendent of Documents, Government Printing Office, who has copies of all department publications for sale.

The form and typographical appearance of the majority of the department publications have been materially altered with a view to their improvement and economical printing. They now appear without cover, title page, or table of illustrations, thus enabling the department to give a wider distribution to its publications because of the saving by the omission of this preliminary matter.

The former practice of printing in single-sheet form the decisions, notices of judgment, quarantine and other orders based on the various regulatory acts intrusted to the department for enforcement resulted in confusing the public, who found it difficult to obtain complete knowledge of all the regulatory matters enacted by the department during a given period. Hence, beginning with February 1, 1914, monthly Service and Regulatory Announcements for each bureau or board charged with the enforcement of regulatory acts were issued. These announcements were numbered consecutively with a view to bringing together eventually, perhaps annually, all the announcements for each bureau, division, and office, and a limited number of copies will be indexed and bound.

A radical change was also made in the publication known as the Organization Lists of the Agricultural Colleges and Experiment Stations by inserting in it the organization of the Federal Department of Agriculture, followed by the organization of the agricultural colleges and agricultural experiment stations located in the various States, and the title of this publication was changed to "List of Workers in Subjects Pertaining to Agriculture and Home Economics in the U. S. Department of Agriculture and in the State Agricultural Colleges and Experiment Stations."

Sufficient time has elapsed to justify the observation that there is no place in the present classification of our publications for occasional bulletins and reports such as were formerly included in the bureau series of publications. It is believed that a new series should be established, or an old one revived, for the publication of material which is not adapted to the series now in existence.

COMMITTEE ON EXAMINATION OF MANUSCRIPTS.

At the beginning of the fiscal year there were more than 60 manuscripts which it had not been possible to publish during the preceding year on account of insufficient funds and which had thus accumulated in this division. A committee consisting of Prof. William A. Taylor, chairman, Prof. Milton Whitney, and Mr. Joseph A. Arnold was appointed by the Assistant Secretary to examine these manuscripts and to ascertain if they were suitable for publication under the new classification of department publications which had then just been

adopted. The committee very carefully considered the manuscripts, making recommendations to the Assistant Secretary with regard to them. Many of the manuscripts required alterations to adapt them to the new series, while some were recommended for publication outside the department, it being thought that the information they contained could be brought to the attention of those most interested through the medium of private publications.

This committee continued throughout the year to examine and make recommendations with regard to all manuscripts submitted for publication. Other questions relating to the publication work of the department were referred to it by the Secretary and Assistant Secretary from time to time.

EXPENDITURES FOR PRINTING AND BINDING.

The number of requisitions for printing and binding made upon the Government Printing Office during the year was 15,200. The appropriation for printing and binding was $15,000 more than that for the preceding fiscal year, or $490,000. Of this amount $47,000 was appropriated for the Weather Bureau. Of the remaining $443,000, $305,336.06 was expended for miscellaneous publications, job printing and blank books, binding, etc., for the various bureaus, and $136,854.75 for Farmers' Bulletins.

The amounts expended for job work and binding and for regular publications, miscellaneous documents, and circulars, arranged by bureaus, divisions, and offices, are given in the following table:

Expenditures for job work and binding and for regular publications, miscellaneous documents, and circulars, arranged by bureaus, divisions, and offices, during the fiscal year ended June 30, 1914.

Bureau.	Job work and binding.	Regular publications, miscellaneous documents, circulars, and reports.	Total.
Division of Accounts and Disbursements	$2,801.53	$28.71	$2,830.24
Bureau of Animal Industry	13,191.04	12,368.22	25,559.26
Bureau of Biological Survey	798.01	5,337.12	6,135.13
Bureau of Chemistry	4,520.85	12,392.78	16,913.63
Bureau of Entomology	2,309.11	4,784.34	7,093.45
Office of Experiment Stations	3,546.47	31,188.60	34,735.07
Forest Service	14,290.69	10,066.61	24,357.30
Library	11,103.68	242.16	11,345.84
Bureau of Plant Industry	16,528.26	17,262.84	33,791.10
Office of Public Roads	757.71	2,022.78	2,780.49
Division of Publications	1,298.95	11,210.01	12,508.96
Bureau of Soils	848.98	46,472.00	47,320.98
Bureau of Statistics	8,559.13	1,175.58	9,734.71
Miscellaneous (Secretary)	10,200.04	192,886.64	203,086.68
Insecticide and Fungicide Board	271.84	1,296.17	1,568.01
Federal Horticultural Board	394.28	420.25	814.53
Office of Markets	940.43	675.00	1,615.43
Weather Bureau	17,952.97	26,640.80	44,593.77
Total	110,313.97	376,470.61	486,784.58

The following tabulated statement shows the total expenditures for the department, by bureaus, divisions, and offices, classified according to the kind and character of the work secured:

Expenditures for printing and binding (arranged by bureaus, divisions, and offices) for the fiscal year ended June 30, 1914.

Bureau, division, or office.	Blank forms.	Letterheads.	Envelopes.	Miscellaneous administrative circulars, orders, decisions, notices, etc.	Index cards.	Memoranda sheets.	Blank books.	Binding.	Posters, placards, labels, maps, etc.	Compilation of laws, manuals, fiscal regulations, etc.	Separates and unnumbered pamphlets.	Publications and Department Bulletins.	Periodical publications.	Congressional.	Farmers Bulletins.	Total cost.
Division of Accounts and Disbursements	$1,841.00	$13.09	$31.25	.....	$627.80	$12.89	$218.65	$56.85	.....	.....	.....	.....	.....	$28.71	.....	$2,830.24
Bureau of Animal Industry	7,766.58	1,324.41	6.18	$3,614.00	1,005.54	.....	1,836.82	221.50	$1,030.01	.....	$2,457.43	$4,940.45	.....	1,356.34	.....	25,559.26
Bureau of Biological Survey	60.43	93.06	6.40	171.38	130.31	28.09	19.61	157.43	302.68	.....	171.87	4,951.78	.....	42.09	.....	6,135.13
Bureau of Chemistry	1,141.44	539.94	16.10	9,367.59	568.50	349.36	241.57	1,635.15	28.79	.....	557.07	2,443.15	.....	24.97	.....	16,913.63
Bureau of Entomology	426.21	100.90	65.79	.....	490.65	1.08	105.32	161.29	957.87	.....	595.53	4,151.68	.....	37.13	.....	7,093.45
Office of Experiment Stations	501.69	391.72	.....	2,928.26	1,160.52	29.52	98.33	1,349.39	15.30	.....	810.44	5,412.76	$20,688.81	1,348.33	.....	34,735.07
Forest Service	7,107.00	303.09	.....	1,171.05	1,457.02	133.80	3,801.97	989.17	498.64	$1,282.80	1,299.03	6,135.44	.....	178.29	.....	24,357.30
Library	133.65	28.65	2.15	7.09	1,465.78	11.72	.....	9,456.74	4.99	.....	.....	.....	200.93	34.14	.....	11,345.84
Bureau of Plant Industry	4,940.33	3,132.74	167.61	1,275.03	2,836.80	84.15	2,862.02	1,642.62	861.99	.....	6,078.02	9,833.45	.....	76.34	.....	33,791.10
Office of Public Roads	420.40	50.36	2.30	.....	115.92	.....	10.98	27.31	130.44	.....	.....	1,977.04	.....	45.74	.....	2,780.49
Division of Publications	187.56	162.89	4.09	134.63	634.07	.....	25.12	127.53	157.69	.....	7,570.79	.....	3,439.33	65.26	.....	12,508.96
Bureau of Soils	118.89	210.88	.....	258.83	165.02	.....	195.83	158.36	.....	.....	332.01	5,568.58	.....	40,312.58	.....	47,320.98
Bureau of Statistics	7,727.13	486.14	96.77	151.62	215.37	.....	.....	26.10	7.62	.....	719.32	280.77	.....	23.87	.....	9,734.71
Miscellaneous (Secretary)	4,163.17	1,498.26	128.03	1,236.64	402.75	128.01	441.47	1,480.42	1,957.93	903.88	252.66	480.24	19,616.36	33,542.11	$136,854.75	203,086.68
Insecticide and Fungicide Board	87.95	35.25	.....	1,288.13	120.25	.....	22.89	.....	5.50	.....	.....	.....	.....	8.04	.....	1,568.01
Federal Horticultural Board	311.14	27.45	.....	373.88	28.60	.....	13.68	.....	13.41	.....	.....	.....	.....	46.37	.....	814.53
Office of Markets	296.62	88.26	62.87	60.42	126.69	6.71	82.30	276.98	.....	.....	275.16	339.42	.....	.....	.....	1,615.43
Weather Bureau	13,470.16	.....	.....	.....	220.19	.....	242.42	3,275.42	744.78	.....	682.30	4,217.53	16,710.08	5,030.89	.....	44,593.77
Total	50,701.35	8,487.09	589.54	22,038.55	11,771.68	785.33	10,218.98	21,042.26	6,717.64	2,186.68	21,801.63	50,732.29	60,655.51	82,201.20	136,854.75	486,784.58

Total appropriation for the department	$490,000.00	Appropriation for department, exclusive of Weather Bureau and Farmers' Bulletins	$305,500.00	Appropriation for Farmers' Bulletins	$137,500.00
Total expenditures	486,784.58	Expenditures exclusive of Weather Bureau and Farmers' Bulletins	305,336.06	Expenditures for Farmers' Bulletins	136,854.75
Balance	3,215.42	Balance	163.94	Balance	645.25

NOTE.—The Division of Publications does not have supervision of the appropriation for the Weather Bureau. A statement of the expenditures for that bureau, however, is included in order to show the total expenditures for printing and binding for the department.

CLASSES OF WORK INCLUDED UNDER EACH HEAD IN ABOVE TABLE.

Blank forms.—Includes all blank forms, jackets, tags, and photo mounts.

Letterheads.—Includes all letterheads, noteheads, and second sheets.

Envelopes.—Includes envelopes, packets, and official mailing wrappers.

Miscellaneous administrative circulars, orders, decisions, notices, etc.—Includes B. A. I. orders, B. A. I. directory, regulations, service and regulatory announcements, field programs, notices of judgment, food inspection decisions, slips giving instructions to workers, circular letters, lists of workers, financial reports, area tables, notices of quarantine.

Index cards.—Includes all cards.

Memoranda sheets.—Includes blank sheets and scratch pads.

Blank books.—Includes all blank books.

Binding.—Includes all binding, binders, folders, tabs, manuscript covers, index sheets, pressboard sheets, and muslin bags.

Posters, placards, labels, maps.—Includes all posters, placards, labels, maps, notices of warning, lantern-slide mats, charts, proofs, and copies of photos, calendars, and book plates.

Compilation of laws, manuals, fiscal regulations.—Includes work enumerated.

Unnumbered pamphlets.—Includes unnumbered circulars and publications, Yearbook separates and separates from the Journal of Agricultural Research, lists of Farmers' Bulletins, and other publications and inventories.

Publications and department bulletins.—Includes all numbered publications of the bureau series, and department bulletins.

Periodical publications.—Includes the Weekly News Letter, Journal of Agricultural Research, Experiment Station Record, Monthly List of Publications, and Monthly Bulletin of the Library.

Congressional.—Includes Yearbook, Field Operations of the Bureau of Soils, soil surveys, annual reports, and congressional documents.

TOTAL OUTPUT FOR THE YEAR.

A résumé of the printing and binding expenditures of the department and the total number of copies of all kinds of printed matter distributed is shown in the following table:

Total number of copies of publications, documents, circulars, blanks, blank books, and bound volumes ordered for the various bureaus, divisions, and offices during the fiscal year ended June 30, 1914.

Class.	Copies.	Cost.	Class.	Copies.	Cost.
Miscellaneous publications and job work:			Miscellaneous publications and job work—Contd.		
Division of Accounts and Disbursements	700,025	$2,830.24	Bureau of Plant Industry	9,078,932	$33,791.10
Bureau of Animal Industry	9,209,695	25,559.26	Division of Publications	10,302,204	12,508.96
Bureau of Biological Survey	507,535	6,135.13	Office of Public Roads	216,682	2,780.49
Bureau of Chemistry	5,576,136	16,913.63	Office of the Secretary	6,200,729	66,231.93
Bureau of Entomology	2,195,671	7,093.45	Bureau of Soils	349,517	47,320.98
Office of Experiment Stations	1,053,181	34,735.07	Bureau of Statistics	3,410,788	9,734.71
Federal Horticultural Board	253,700	814.53	Weather Bureau	10,342,446	44,593.77
Forest Service	6,121,052	24,257.30	Total	67,072,423	486,784.58
Insecticide and Fungicide Board	764,600	1,568.01	Farmers' Bulletins	14,960,000	136,854.75
Library	1,019,361	11,345.84	Mimeographed circulars of information	2,618,035	.....
Office of Markets	270,169	1,615.43	Grand total	84,650,458	.....

For the purpose of comparison the following statement, showing the number of publications of the department and the number of copies printed for the five years 1910, 1911, 1912, 1913, and 1914, is given:

Item.	1910	1911	1912	1913	1914
Number of editions issued	1,983	1,953	2,110	2,200	1,626
Number of copies printed	25,190,465	27,594,877	34,678,557	33,356,366	38,186,392

The following statement shows the total number of copies of all publications of the department issued during the last 25 years:

Publications of all kinds issued by the department, 1890–1914.

Year.	Number issued.	Year.	Number issued.	Year.	Number issued.	Year.	Number issued.
1890	1,904,300	1897	6,541,210	1904	12,421,386	1911	27,594,877
1891	2,833,933	1898	6,280,365	1905	12,475,157	1912	34,678,557
1892	2,348,797	1899	7,075,975	1906	13,488,527	1913	33,356,366
1893	3,446,181	1900	7,152,428	1907	16,746,910	1914	38,186,392
1894	3,169,310	1901	7,889,281	1908	16,875,516		
1895	4,100,660	1902	10,586,580	1909	17,190,345	Total	329,793,782
1896	6,561,700	1903	11,698,564	1910	25,190,465		

PUBLICATIONS OF THE WEATHER BUREAU.

With the appropriation of $47,000 allotted to it, the Weather Bureau procured from the Government Printing Office 10,342,466 pieces of printed matter, in addition to the daily weather maps, cards, etc., issued from the branch printing office provided for in the Agriculture appropriation bill.

The printing division of the Weather Bureau continued to issue and distribute the daily weather maps and forecast cards, the National Weather Bulletin, Snow and Ice Bulletin, Monthly Weather Review, and Monthly Meteorological Summary.

The publication of the marine meteorological charts was discontinued at the close of the fiscal year 1913.

Two bulletins of the lettered series were published during the year, viz, Bulletin Y, The Ohio and Mississippi Floods of 1912, and Bulletin Z, The Floods of 1913 in the Rivers of the Ohio and Lower Mississippi Valleys.

Since January 1, 1914, a daily weather map of the Northern Hemisphere has been printed on the reverse side of the second edition of the Washington map.

Beginning with January, 1914, the Bulletin of the Mount Weather Observatory was combined with the Monthly Weather Review, and the climatological statistics formerly published in the Review were transferred to the volume of Climatological Data issued monthly as a compilation of the section statistics printed at stations.

The total daily, weekly, or monthly issue and disposition of periodical publications at the close of the fiscal year was as follows:

Issues of Weather Bureau periodicals.

Publication.	Domestic addresses.	Foreign addresses.	Total.
Weather maps, first edition, daily	1,050	.....	1,050
Weather maps, second edition, daily	400	100	500
Monthly Weather Review	860	355	1,215
Climatological Data, monthly	340	71	411
National Weather Bulletin, weekly (monthly from October to March)	3,725	50	3,775
Snow and Ice Bulletin, weekly during winter	1,287	13	1,300
Monthly Meteorological Summary (Form No. 1030)	175	.....	175

In addition to the publications issued at Washington, the Weather Bureau stations throughout the country print or otherwise prepare large numbers of daily weather maps, weather bulletins, river bulletins, cotton region bulletins, and forecast cards. Commercial weather maps were being printed by 70 newspapers at the end of the year.

SALES OF DEPARTMENT PUBLICATIONS.

Notwithstanding the free distribution of publications by the department, the sales by the Superintendent of Documents aggregated during the year 231,821 copies, for which $21,708.76 was received. The sales of the department's publications within the last four years are shown in the accompanying table:

Sales of agricultural publications by the Superintendent of Documents during the fiscal years 1910–1914.

Years.	Number of copies.	Amount received.	Years.	Number of copies.	Amount received.
1910	147,327	$18,398.18	1913	183,139	$17,885.40
1911	183,577	18,657.17	1914	231,821	21,708.76
1912	171,866	16,428.07			

It will be observed that the number of copies sold during this fiscal year was 48,682 more than the number sold in 1913, and the amount received was $3,823.36 more than last year.

AUTHORITY TO REPRINT.

Under a provision of the law of January 12, 1895, the Superintendent of Documents is authorized to reprint and sell any publication, the proceeds to cover the cost and handling thereof. It is possible, therefore, to secure Government publications from that official when they can no longer be obtained from the department issuing them. In compliance with requests for such publications, this official reprinted during the year 731 different documents issued by the United States Department of Agriculture, the number of copies aggregating 191,275. This was 119 more documents and 66,500 more copies than were reprinted during the preceding year.

Under the law all remittances for publications should be forwarded to the Superintendent of Documents, Government Printing Office. Although instructions are printed at the head of the Monthly List of Publications advising applicants to apply to that official when they desire to obtain publications after the department's supply is exhausted, remittances continue to be sent to this office, the amount received during the year being $2,911.50. A careful record of all moneys so received and forwarded to the Superintendent of Documents is kept in this division.

FARMERS' BULLETINS.

The Farmers' Bulletins continue to increase in popular favor. In fact, there has been a larger demand and a distribution 50 per cent greater than ever before. Since the series was established in 1890, 597 bulletins have been issued. During the year 55 new Farmers' Bulletins were prepared and issued, the total number of copies being 4,730,000. Of earlier numbers still in demand 284 were reprinted, the number of copies being 10,230,000, making an aggregate of Farmers' Bulletins issued during the year of 14,960,000. The plans made at the beginning of the year have been followed, and the new bulletins show an improvement in brevity, clearness of statement, and adaptation to restricted localities. The following table gives the output of Farmers' Bulletins during the last eight years and the expenditures therefor:

Output of Farmers' Bulletins and the cost for the fiscal years 1907, 1908, 1909, 1910, 1911, 1912, 1913, and 1914.

Fiscal year.	Fund drawn upon.	Number issued.	Number of copies.	Cost.
1907	Farmers' Bulletin fund	235	6,469,000	$98,601.17
1908	do	252	6,574,500	98,601.49
1909	do	271	7,755,000	122,475.48
1910	do	299	9,337,500	126,579.37
1911	do	295	9,219,000	118,012.06
1912	do	344	10,409,000	122,753.33
1913	do	327	9,680,850	109,472.11
1914	do	339	14,960,000	136,854.75

CONGRESSIONAL DISTRIBUTION OF FARMERS' BULLETINS.

The appropriation for Farmers' Bulletins for the year was $137,500, an increase of $12,500 to permit the allotment of quotas to new Members added to the Sixty-third Congress, and the same quota of 12,500 copies was allotted therefore to each Senator, Representative, and Delegate in Congress. With the above appropriation it was possible to print nearly 15,000,000 copies, of which 8,399,659 were distributed upon the orders of Senators, Representatives, and Delegates.

In this connection the following table is interesting, as showing the growth of the Farmers' Bulletin series during 25 years, with the congressional distribution for each year:

Growth of the Farmers' Bulletin series during 25 years, with congressional distribution.

Year.	New bulletins issued.	Total number of copies printed.	Copies distributed by Congressmen.	Year.	New bulletins issued.	Total number of copies printed.	Copies distributed by Congressmen.
1890–1893	14	540,000	.....	1905	24	5,925,500	4,782,643
1894	5	278,500	.....	1906	33	6,568,000	5,279,476
1895	11	1,567,000	885,770	1907	42	6,469,000	3,484,713
1896	13	1,891,000	1,316,695	1908	26	6,574,500	3,928,437
1897	16	2,387,000	1,967,237	1909	34	7,755,000	3,960,642
1898	21	2,170,000	1,580,065	1910	45	9,337,500	6,449,589
1899	22	2,437,000	1,101,985	1911	48	9,219,000	5,474,079
1900	18	2,360,000	1,666,909	1912	44	10,409,000	7,351,262
1901	14	3,345,000	2,195,010	1913	42	9,680,850	5,803,088
1902	23	6,150,000	4,289,126	1914	55	14,960,000	8,399,759
1903	22	6,602,000	3,954,976				
1904	25	6,435,000	4,895,556	Total	597	123,060,850	78,768,017

EDITING.

The changes in classification and form of the publications, already described, have increased the amount of work required of the editors, although the number of new publications was less than shown for the previous year. The following table shows the number of new publications and reprints issued during each of the last 10 years (1905 to 1914, both inclusive):

Number of publications issued.

Class.	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914
New publications	391	414	521	447	650	1,085	[1] 1,170	[1] 1,250	[1] 1,771	[1] 1,152
Reprints	596	654	819	998	485	462	696	648	429	474
Total	987	1,068	1,340	1,445	1,135	1,547	1,866	1,898	2,200	1,626

[1] Not including press notices which were mimeographed.

Manuscripts comprising 63,943 folios, with 3,493 illustrations, were read and edited during the year. Proof reading and revising comprised 5,616 galleys and 23,456 pages, besides job work.

The following table presents a detailed statement with regard to publications issued by the department:

Statistics of the publication work of the United States Department of Agriculture for the fiscal year ended June 30, 1914.

Character of published documents.	New.				Earlier issues reprinted.				Total.			
	Number.	Pages.	Illustrations.	Copies.	Number.	Pages.	Illustrations.	Copies.	Number.	Pages.	Illustrations.	Copies.
Miscellaneous administrative circulars, orders, decisions, notices, etc. (B. A. I. Orders, B. A. I. Directory, regulations, service and regulatory announcements, field programs, notices of judgment, food inspection decisions, notices of quarantine, instructions to workers, lists of workers, circular letters, financial reports, etc.)	548	2,133	.....	5,260,500	60	362	.....	113,000	608	2,495	.....	5,373,500
Compilation of laws, manuals, fiscal regulations, etc	20	190	.....	108,000	.....	.....	.....	.....	20	190	.....	108,000
Separates and unnumbered pamphlets (Yearbook separates, separates from Journal of Agricultural Research, lists of Farmers' Bulletins and other publications, and inventories)	135	2,660	454	8,162,800	12	154	38	650,000	147	2,814	492	8,812,800
Publications and Department Bulletins (numbered pamphlets of the bureau series and department series)	137	4,499	658	1,039,400	118	2,151	393	501,700	255	6,650	1,051	1,541,100
Periodical publications (Weekly News Letter, Journal of Agricultural Research, Experiment Station Record, Monthly List of Publications, monthly bulletins of the Library and the Weather Bureau)	178	6,827	1,478	6,656,118	.....	.....	.....	.....	178	6,827	1,478	6,656,118
Congressional (Yearbook, Field Operations of the Bureau of Soils, soil surveys, annual reports, and congressional documents)	79	4,270	257	734,874	.....	.....	.....	.....	79	4,270	257	734,874
Farmers' Bulletins	55	1,059	293	4,730,000	284	8,310	2,596	10,230,000	339	9,369	2,889	14,960,000
Total	1,152	21,638	3,140	26,691,692	474	10,977	3,027	11,494,700	1,626	32,615	6,167	38,186,392

It will be seen from the foregoing that the new numbered bulletins are 137, but by adding the other documents which should properly be classed as publications the aggregate of new published documents is 1,152. This is 619 less than last year, while the aggregate copies issued is 26,691,692, an increase of 3,016,170 over the preceding year.

The editorial work was under the immediate supervision of the editor and assistant chief, B. D. Stallings.

INDEXING.

The indexes made and maintained in the division are becoming steadily more useful to persons in other branches of the department. This is shown by the multiplication several times in 1914, as compared with 1913, of calls for references to subjects covered by the department publications.

By means of the subject card index it is possible readily to ascertain what the department has published since its organization. Investigators and others in the department and elsewhere will find this index very helpful, and the increase in its use is very gratifying.

A card index for the Congressional Record has also been made and added to the indexes previously maintained.

The number of cards written, together with those copied, during the year has totaled 98,528; the number of pages indexed, including the Congressional Record, 49,590.

The books for the vault sets have been secured as issued and have been kept as well as conditions would allow. Attention is called to the unprotected condition of these books, which are intended to form permanent complete sets in case of destruction of other sets. No steps have been taken to prevent depredation upon them since they were transferred from rented storage to the attic of the east wing of the department. A recent examination of them shows that they are probably still comparatively safe and the seals unbroken, but there can be no guaranty of the fact under existing conditions. It is believed that these valuable and perhaps the only complete sets of the department publications should be placed in the custody of the Librarian.

The indexing was under the immediate supervision of C. H. Greathouse.

ILLUSTRATING.

During the year 2,061 drawings were prepared by the draftsmen, as compared with 1,512 in the preceding year. Many of these drawings required an unusual amount of time and care in their preparation, so that the numerical increase alone does not fully show the conscientious efforts and assiduity of the three draftsmen comprising the force.

Summary of drawings prepared during the fiscal year 1914.

Office of the Secretary	355
Bureau of Plant Industry	513
Bureau of Animal Industry	299
Bureau of Chemistry	194
Bureau of Biological Survey	73
Bureau of Statistics	371

Bureau of Soils	2
Bureau of Entomology	37
Office of Experiment Stations	48
Division of Publications	116
Office of Public Roads	3
Office of Markets	6
Total	2,017

In the photographic laboratory a total of 112,272 pieces were prepared, as compared with 83,605 pieces during the preceding year, an increase of over 35 per cent.

This large increase demonstrates the growing tendency of the various bureaus and offices to avail themselves of the facilities of this laboratory for producing technically and artistically correct photographs, and emphasizes the urgent need for better quarters than the present laboratory space on the attic floor of the administration building affords.

Summary of photographic work done during the fiscal year 1914.

Contact prints, developing paper	68,298
Negatives made	6,182
Lantern slides	8,528
Lantern slides colored	643
Stereoscopic slides	67
Plates and films developed	6,413
Bromide enlargements	2,807
Bromide enlargements colored	4
Solar bromide prints	3,311
Blue prints	13,726
Prints mounted	2,283
Total	112,262

Photographic work done for the different bureaus, divisions, and offices of the department and for the public during the fiscal year 1914.

Bureau, division, or office.	Contact prints made.	Negatives made.	Lantern slides made.	Lantern slides colored.	Stereoscopic slides made.	Plates and films developed.	Bromide enlargements made.	Solar bromide prints made.	Blue prints made.	Prints mounted.	Total.
Office of the Secretary	2,633	411	55	.....	67	6	308	736	214	774	5,204
Bureau of Plant Industry	38,638	3,626	2,173	244	.....	4,862	1,840	1,177	1,044	514	54,118
Bureau of Animal Industry	8,138	777	2,785	38	.....	322	234	118	5,699	264	18,375
Bureau of Chemistry	2,565	368	345	69	.....	78	47	94	195	29	3,790
Bureau of Statistics	100	4	.....	.....	.....	.....	.....	286	.....	.....	390
Bureau of Soils	18	15	.....	.....	.....	105	.....	51	12	.....	201
Bureau of Entomology	2,076	242	81	.....	.....	204	4	39	10	74	2,730
Office of Experiment Stations	5,281	329	1,863	280	.....	254	320	667	5,834	593	15,421
Division of Publications	3,959	351	7	7	.....	30	6	117	66	.....	4,543
Office of Public Roads	.....	.....	.....	.....	.....	.....	18	.....	575	.....	593
Office of Markets	1,877	50	.....	.....	.....	552	4	26	31	5	2,545
Paid orders	3,013	9	1,219	5	.....	.....	30	.....	46	30	4,352
Total	68,298	6,182	8,528	643	67	6,413	2,811	3,311	13,726	2,283	112,262

One hundred and ninety-five requests for photographic work were received from persons outside of the department, for which $771.94 was collected and turned over to the disbursing office. Besides these paid orders, a number of requests were received for duplicates of cuts of illustrations appearing in department publications. These duplicates were furnished by electrotypers at the applicant's expense.

Under authority of Memorandum No. 55, Office of the Secretary, dated December 18, 1913, the Division of Publications was authorized to install a motion-picture laboratory, to purchase the necessary apparatus, and to produce motion pictures for visual instruction in agriculture under the direction of the motion-picture committee appointed by authority of the same memorandum.

The Division of Publications has among its employees several expert motion-picture photographers, and the laboratory has taken and developed up to the end of the fiscal year 1914 a total of 14,675 feet of negative film, covering 19 educational subjects. It has cooperated with the Panama-Pacific International Exposition Board in taking and developing subjects for other departments, the expense being defrayed by the board or the department interested. Twelve reels, totaling 12,275 feet of positive film, have been printed, comprising the following subjects:

1. Annual chrysanthemum show of the Department of Agriculture.
2. Cooperative cow testing in Vermont.
3. Boy and girl club winners on prize trip to Washington.
4. Bridge-grafting of trees.
5. Office of Public Roads laboratory work.
6. Egg rolling on White House grounds (Exposition Board).
7. Destroying wrecks impeding navigation (Treasury Department).
8. Work of the Forest Products Laboratory at Madison, Wis.
9. Horse-breeding experiments, Middlebury, Vt.
10. May festival of kindergarten pupils (Bureau of Education).
11. Drill of cadet corps on White House Ellipse (Exposition Board).
12. Repairing of the original Star Spangled Banner (Smithsonian Institution).

Several of the finished reels were exhibited to farm and other audiences, and the agents of the department showing them have reported in each instance that they were received enthusiastically by the spectators and were of decided educational value.

The illustration work was under the immediate supervision of A. B. Boettcher.

DISTRIBUTION OF DOCUMENTS.

Notwithstanding the fact that there was a falling off in the number of miscellaneous publications distributed as compared with the preceding year, the decrease was largely offset by an increase of 5,479,000 shown in the number of Farmers' Bulletins distributed, which increase was divided between miscellaneous and congressional distribution.

On July 1, 1913, there were 5,345,881 publications either at the Government Printing Office or in this division available for distribution, consisting of 1,365,410 miscellaneous pamphlets and 3,980,471 Farmers' Bulletins. Adding the publications issued during the year ended June 30, 1914, to those on hand at the beginning of that year, there was an aggregate of 35,046,276 documents, not including those issued by the Weather Bureau, available for distribution through this division. Of these 29,228,766 were distributed, leaving a balance on hand in July, 1914, of 5,817,510. The distribution of the two classes

of publications, Farmers' Bulletins and miscellaneous, for the first time in the history of the department was practically equal, 14,328,976 Farmers' Bulletins and 14,899,730 miscellaneous pamphlets being sent out to various addresses. In addition to the above output of publications containing information for the general public, 6,661,750 lists of Farmers' Bulletins were distributed, largely upon the orders of Senators, Representatives, and Delegates, bringing the entire distribution accomplished through this division up to the number of 35,890,516.

This brief statement of the distribution of the department's publications does not fully cover the work entailed, for there were received from Senators, Representatives, and Delegates in Congress 54,780 letters requesting that publications be mailed to their constituents, to each of which a reply acknowledging its receipt and detailing the action taken was sent. To comply with the requests contained in this correspondence, it was necessary to issue 47,037 orders on the Public Printer for Farmers' Bulletins and 32,659 for miscellaneous publications.

The total number of typewritten communications to correspondents amounted to 94,988. A large part of these contained information to miscellaneous applicants whose requests could not be supplied by forwarding a printed publication.

Letters written in connection with the distribution of documents numbered 86,818, while the number of reference slips prepared was 8,180.

Within the past year 640,000 persons have written to the department applying for publications, to comply with which 636,400 orders on the Public Printer directing that publications be mailed from the department's supply in his office were written and 630,000 cards advising the applicants of the price of the publications the department's supply of which had been exhausted, but which could be purchased from the Superintendent of Documents, were mailed.

MACHINE ADDRESSING, DUPLICATING, AND FOLDING WORK.

This branch of the work greatly increased its output. Here are duplicated numerous miscellaneous circular letters for immediate use by the different bureaus, divisions, and offices. There was an increase of more than 100 per cent in machine-addressed work. This increase follows the assignment to this division of the addressing work of the Office of Information, which requires several thousand envelopes daily.

The greatest increase was shown in the duplicating on the flexotype and mimeograph machines. The number of forms, announcements, and notices run off in typewriter form on duplicating machines for the various branches of the department was 1,783, comprising 2,618,035 copies and 4,040,219 pages, an increase of 150 per cent over last year. The greater part of this was produced by the work involved in assisting the Office of Information, that office alone requiring 589 different jobs, calling for 1,073,779 copies comprising 2,162,969 pages of matter to be folded and mailed to the press from this division.

A detailed statement showing the work done for the various offices and divisions by the force in the labor-saving machine room is given below:

Number of stencil addresses cut	54,240
Number of stencil addresses removed	24,948
Number of envelopes and franks addressed	3,686,877
Number of congressional franks cut	775,316
Number of sheets paper cut for various bureaus	1,432,583
Number of pads made for various bureaus	13,548
Number of circulars, etc., folded	2,205,058

The total number of stencils belonging to the various branches of the department is 116,324.

MAINTENANCE OF MAILING LISTS.

Records of the various mailing lists of the department now maintained at the Government Printing Office, numbering 271 lists and aggregating 484,628 addresses, are kept, revised, and added to upon necessity or upon notification from the various bureaus.

During the year 165,298 cards were written and transmitted to the Government Printing Office in order that stencils might be cut for the same there, and a like number of cards were written for insertion in the general index of addresses maintained here; 183,000 cards of addresses were prepared for the Monthly List of Publications and the Agricultural Outlook, and in addition to the regular work the following miscellaneous work was necessary:

Addressed franks and envelopes, aggregating 190,560, were written for other bureaus, divisions, and offices; 1,077,665 circulars and lists of Farmers' Bulletins were counted and folded, and 500 sets of Food Inspection Decisions and Notices of Judgment were collected and prepared for binding.

FOLDING AND MAILING.

Although the distribution of the department's publications to the general public is mainly performed through the Government Printing Office, there were a number of blanks, administrative circulars, and other department documents which were handled by the force employed within this division. Work of this character greatly increased during the past year and 10,129,979 pieces of such matter were folded and distributed. In fact, the increased amount of folding and mailing work requiring prompt attention daily seriously interfered with the proper sorting and storing of publications and the filling of orders.

The above large aggregate of printed matter handled within this division is composed of printed matter requiring prompt, immediate, or departmental distribution.

In addition to the distribution through the Superintendent of Documents, there were distributed by this office the following: 120,000 copies of the Monthly Lists of Publications, 958,000 copies of the Weekly News Letter, 200,000 copies of the Agricultural Outlook, 889,669 press notices, over 6,500,000 lists of Farmers' Bulletins, and various other miscellaneous publications. A great many publications are daily selected and given to applicants who call at the office.

MAILING PUBLICATIONS TO FOREIGN COUNTRIES.

All the publications of the department dispatched to foreign countries are handled here. Some of them are forwarded by the International Exchange through the Smithsonian Institution and others, under postage, direct from the department.

During the fiscal year 58,546 packages, weighing 21,888 pounds, were shipped. Of this number, 45,352 packages, weighing 15,978 pounds, required postage amounting to $1,279.25; and 13,194 packages, weighing 5,910 pounds, were forwarded through the Smithsonian Exchange.

The number of packages requiring postage is nearly 3,000 larger than those sent by that means last year, but this is due to the fact that it was found necessary to send certain serial publications to foreign addresses more promptly than could be done by dispatching them through the Smithsonian Exchange.

The total amount expended for postage is $85.62 less than the amount expended for this purpose last year, which, in view of the increased number of packages, is accounted for by the fact that the total weight of the same was 1,082 pounds less than last year.

A statement showing in detail the foreign mail is given below:

Summary of foreign mail for the year ended June 30, 1914.

Bureau, division, or office.	Packages requiring postage.			Sent through the Smithsonian Exchange.		Total.	
	Number.	Weight.	Postage.	Number.	Weight.	Number.	Weight.
		Lbs. oz.			*Pounds.*		*Lbs. oz.*
Library	16,378	4,889 0	$423.12	2,826	1,156	19,204	6,045 0
Office of Experiment Stations	10,855	5,474 8	437.96	3,021	1,907	13,876	7,381 8
Bureau of Chemistry	4,009	832 10	66.61	941	451	4,950	1,283 10
Office of the Secretary	3,231	770 8	61.64	154	60	3,385	830 8
Journal of Agricultural Research	2,917	1,584 12	126.78	671	386	3,588	1,970 12
Bureau of Animal Industry	2,220	744 0	58.72	1,456	502	3,676	1,246 0
Bureau of Entomology	1,857	379 8	30.36	1,240	434	3,097	813 8
Bureau of Crop Estimates	1,652	280 4	22.42	2,124	650	3,792	930 4
Bureau of Soils	1,038	169 10	13.57	307	130	1,345	299 10
Forest Service	476	181 2	14.49	197	119	673	300 2
Bureau of Plant Industry	450	210 12	16.86	159	70	609	280 12
Biological Survey	98	36 12	2.94	71	40	169	76 12
Office of Public Roads	91	15 10	1.25	4	1	95	16 10
Office of Markets	65	8 2	.65			65	8 2
Division of Publications	15	11 0	.88	7	4	22	15 0
Total	45,352	15,978 2	1,279.25	13,194	5,910	58,546	21,888 2
Total for fiscal year 1913	42,437	17,060 14	1,364.87	14,716	8,145	57,153	25,205 14
Total for fiscal year 1914	45,352	15,978 2	1,279.25	13,194	5,910	58,546	21,888 2
Decrease during fiscal year 1914	(1)	1,082 12	85.62	1,532	2,335	1,393	3,317 12

[1] Increase of 2,915 packages requiring postage.

TOTAL SENT ABROAD DURING THE FISCAL YEAR 1914.

Item.	Number.	Weight.	Postage.
		Lbs. oz.	
Packages to which postage was affixed	45,352	15,978 2	$1,279.25
Packages sent through the International Exchange, Smithsonian Institution	13,194	5,910 0	(1)
Grand total	58,546	21,888 2	1,279.25

[1] The Smithsonian Institution is reimbursed from the department's contingent fund at the rate of 5 cents per pound.

Early in March, 1914, the subject of the dispatch of foreign mail received special consideration as the result of reported delays in the delivery of certain of our bulletins and reports. The substance of the recommendation of the committee on manuscripts, which was approved by the Assistant Secretary, was that the bulk of our foreign distribution of publications, whether mailing lists or individual copies, can be handled with satisfactory promptness through the International Exchange, with the exception of the following, which are regarded as requiring prompt delivery and should therefore be sent through the regular mails:

Experiment Station Record.
Service and Regulatory Announcements (of interest to foreign countries).
Journal of Agricultural Research.
Publications intended for reviewing journals.
Such special requests as require prompt attention.

This branch of the work was under the immediate supervision of Francis J. P. Cleary.

REPORT OF THE CHIEF OF THE BUREAU OF STATISTICS (CROP ESTIMATES).

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF CROP ESTIMATES (STATISTICS),
Washington, D. C., October 1, 1914.

SIR: I have the honor to submit herewith the report of the Bureau of Statistics (now Bureau of Crop Estimates) for the fiscal year ended June 30, 1914.

Respectfully,

LEON M. ESTABROOK,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

INTRODUCTION.

During the year ended June 30, 1914, the work of estimating acreages planted, monthly condition, yields at harvest time, and farm prices of the principal crops grown in the United States, including estimates of the numbers and value of farm animals, and the losses from disease, exposure, and other causes, was conducted by the Bureau of Statistics (Crop Estimates) with the same organization and methods which have been fully described in former reports.

EXPENDITURES.

The total appropriation for the Bureau of Statistics (Crop Estimates) for the fiscal year 1914 was $243,680, of which $115,380 was for statutory salaries in Washington and $128,300 was lump sum. The lump-sum appropriation was expended approximately as follows:

Salaries	$77,642
Travel, station, and field expenses	37,668
Office and field supplies and equipment	10,060
Freight, express, and drayage	230
Telegraph and telephone service	1,575

PERSONNEL.

During the same period the total number of salaried employees was 171, of whom 103 were stationed in Washington and 68 in the field. In addition to the salaried employees there were cooperating with the

bureau voluntary crop reporters and special correspondents throughout the United States approximately as follows:

Number of voluntary crop reporters and special correspondents.

Field	5,685	Special peanut	859
State	12,261	Special bean	915
County	2,816	Special broom corn	440
County cotton	775	Special cranberry	140
Township	29,445	Special potato	8,737
Township cotton	7,625	Special apple	1,758
Special price	5,522	Special tobacco	849
Individual farm	21,525	Special bee	4,125
Individual farm cotton	6,066	Special sheep	6,225
Special cotton	4,334	Special truck growers	8,217
Mills and elevators	6,995	Special cane and beet sugar	240
Live stock	5,143	Comparative price	2,541
Live stock at market centers	155		
Special hops	228	Total	143,621

ROUTINE WORK.

During the fiscal year 25,000 letters were received, answered, and filed, approximately 200,000 printed and duplicate form letters were prepared and mailed to the field force, 2,000 accounts were subjected to administrative examination, 329 requisitions for supplies were drawn, and 182,000 packages of vegetable and flower seed, 18,000 Yearbooks, and a large number of other publications were mailed to the voluntary crop reporters of the bureau as a partial recognition of their services. Approximately 354,176 sheets of tabular matter, questionnaires, and form letters were run off on duplicating machines. Nearly 800,000 schedule inquiries were folded and mailed to the field force during the year, and the returns were tabulated, computed, and summarized by the Division of Crop Reports.

FINANCIAL RECORDS.

In June, 1914, the position of financial clerk was merged with that of chief clerk, thereby saving one salary at $1,800 per annum.

REORGANIZATION OF BUREAU OF STATISTICS.

COMMITTEE ON REORGANIZATION.

With a view to improving the crop reporting service, a committee was appointed at the beginning of the fiscal year composed of Milton Whitney, Chief of the Bureau of Soils, J. L. Coulter, expert in charge of the Division of Agricultural Statistics of the Bureau of the Census, C. W. Thompson, economist in the Rural Organization Service, Leon M. Estabrook, Chief Clerk of the Department, and W. J. Spillman, Chief of the Office of Farm Management, to study the organization and methods of the Bureau of Statistics and of other branches of the Government service charged with the duty of collecting and compiling information with respect to agricultural products. This committee made an exhaustive study of the subject and submitted its report and recommendations, which were approved. The recommendations may be summarized as follows:

FUNCTIONS OF REORGANIZED BUREAU.

(1) The functions of the reorganized bureau should be to collect and compile, abstract, analyze, summarize, and interpret data relating to agricultural industries, and to make and publish periodically crop and live-stock forecasts and estimates, including acreage, yield, and value of farm crops, in cooperation with other bureaus and offices of the Department of Agriculture and the statistical agencies of other branches of the National and State Governments.

CHANGE OF TITLE.

(2) A change of title from "Bureau of Statistics" to "Bureau of Crop Estimates" was recommended in order to indicate more clearly the functions of the bureau and the nature of the results of its work. This change of title was adopted in the act making appropriations for the fiscal year 1915 and became effective on July 1, 1914.

BRANCHES OF THE BUREAU AS REORGANIZED.

(3) The organization recommended by the committee consisted of an Administrative Office, a Division of Crop Reports, a Division of Crop Records, a Crop Reporting Board, and a Committee on Cooperation, these units of organization to be made up as follows:

The Administrative Office consists of a chief of bureau and an assistant chief of bureau, a chief clerk, and a small clerical force to handle routine matters of administration, including supervision of the personnel, mails, and files, purchase and custody of office supplies and stationery, financial records, and the bureau library.

The Division of Crop Reports is made up of a field force under the direct supervision of the chief of division and an office force in charge of an assistant chief of division. The field force consists of field agents, one for each State (or group of small States), to collect information and report monthly regarding the crops in each State; a corps of crop specialists, one for each of the more important special crops, each to specialize on a single crop and to travel throughout the region of its growth, disregarding State lines, in order to furnish periodical reports upon acreage, condition, yield, and prices; and a large list of volunteer county and township crop reporters. The office force of the division will continue to handle the clerical work involved in mailing the vast number of schedules and questionnaires to the field force each month, and when received back to open, classify, examine, and tabulate the returns and make all necessary computations for submission to the Administrative Office or to the Crop Reporting Board.

The Division of Crop Records consists of a chief of division, several statistical scientists, and a small clerical force engaged in compiling data relating to crop and live-stock production and prices, chiefly from published statistics, in this and other countries of the world. These estimates are analyzed, condensed, rearranged, and summarized, and when necessary interpreted, so as to make them readily accessible and intelligible when published in the statistical portion of the Yearbook, in other publications of the department, or for use in answering the vast number of inquiries concerning agricultural production and values which are addressed or referred to the bureau.

The Crop Reporting Board consists of the chief of bureau, the assistant chief of bureau, the chief of the Division of Crop Reports, a statistical scientist of the Division of Crop Records, and two field agents representing different crop regions of the country, who are changed at each meeting of the board. As in the past, this board assembles one or more times each month in a room which is kept locked and from which all telephones and other means of communication are disconnected. From the special reports of the field force the board prepares the final estimates of the bureau, which, when approved by the Secretary or Acting Secretary, are issued to the press and telegraphed to the station directors of the Weather Bureau in each State at the hour and minute previously fixed and announced by the Secretary.

The Committee on Cooperation, as a part of the administrative organization, was recommended with a view to securing the closest cooperation between the Bureau of Crop Estimates and other bureaus and divisions of this and other departments of the Government, in order to coordinate and articulate the forecasting, estimating, and statistical work of all those organizations so far as it relates to agriculture.

CHANGES IN FIELD FORCE.

(4) Probably the most important change recommended by the committee on reorganization relates to the strengthening of the field force of the Division of Crop Reports. In addition to the large force of voluntary county, township, and special crop reporters who serve without compensation other than such seeds and publications as the department can supply, the field force consisted of 22 special field agents in the classified civil service at salaries ranging from $1,200 to $2,250 per annum, the average being $1,675, each special field agent being assigned to a group of States; also 47 State statistical agents, one for each State, at salaries ranging from $300 to $1,100 per annum, the average salary being $582.

The special field agents were with few exceptions trained crop reporters and their work was generally satisfactory, but the committee felt that the territory assigned to them was too large for them to cover effectively, even with a large corps of volunteer aids reporting to them monthly, and that much better results could be secured if their territory could be limited to a single State. The State statistical agents were not in the classified civil service, many of them were without previous training or experience in the work of crop reporting, and because of their small salaries they were required to devote only a portion of their time to the work. Practically all of them were regularly employed outside of the department and their service as State statistical agents was simply a side line and suffered accordingly. In the judgment of the committee the expense of maintaining a corps of State statistical agents, amounting to $29,000 per annum, was practically wasted. The committee therefore recommended that the position of State statistical agent be abolished and that an efficient corps of field agents be organized, retaining in service the former special field agents as a nucleus, each agent to be assigned to a single State or to a group of small States which in the aggregate would correspond in area and crop production to one of the larger States.

To supplement the work of the regular field agents in each State, the reorganization committee recommended the employment of crop specialists, one or more for each of the important special crops, such as cotton, tobacco, rice, fruit, and truck crops, possessing the same qualifications and performing the same duties as the State field agents, but devoting their entire time to specializing on the particular crops to which they are assigned and traveling throughout the entire region of their growth. In this way it is hoped that as these crop specialists acquire experience and knowledge they will become recognized authorities on these special crops, just as the field agents will in time become the recognized authorities on crop production within each State.

The bureau already had a special agent engaged in reporting on the tobacco crop and another reporting on the rice crop, and their titles were changed to "crop specialist on tobacco" and "crop specialist on rice," respectively. In addition to these two specialists, a "crop specialist on cotton" was appointed in January, 1914.

REASSIGNMENT OF WORK.

(5) The various projects or lines of work, approximately 45 in number, carried on in the bureau, were carefully scrutinized by the reorganization committee, and as the result of their recommendations the work was reassigned as follows:

WORK ASSIGNED TO THE DIVISION OF CROP REPORTS.

1. Estimates of crops and live stock; acreage, condition, and production in the United States.
2. Estimates of fruit and nut production, the nonstatistical part of this project to be assigned to the Office of Markets and the Office of Horticultural Investigations of the Bureau of Plant Industry.
3. Estimates of the causes and extent of crop damage, in cooperation with the Bureau of Plant Industry, Weather Bureau, and Bureau of Entomology.
4. Compilation of prices of articles bought by farmers, in cooperation with the Rural Organization Service.

WORK ASSIGNED TO THE DIVISION OF CROP RECORDS.

1. Annual estimates of the prices and value of crop products in all agricultural countries of the world.
2. Monthly reports of crop estimates for the International Institute of Agriculture at Rome.
3. Monthly reports of exports and imports for the International Institute of Agriculture at Rome.
4. International sugar situation, the estimates to be made available to the Office of Markets.
5. Estimates of foreign crops, including live stock, from reports of the International Institute of Agriculture at Rome.
6. Preparation of statistical tables for the Yearbook of the department, for other publications, and for use in answering correspondence.
7. Compilation of estimates of acreage of the various crops in the principal countries of the world.
8. Compilation of farm prices of farm products, in cooperation with the Office of Markets; from unofficial sources, for a series of years; items not covered by official price data.
9. Revision of statistical material in publications in order to keep the information up to date and available for immediate use.
10. Estimates of the agricultural population of various countries, in cooperation with the Rural Organization Service.
11. Estimates of production and supply of sugar in the United States, 1881–1912, in cooperation with the Office of Markets and the Office of Sugar Investigations of the Bureau of Plant Industry.

12. Preparation of tables showing imports and exports of farm and forest products, to be condensed and furnished the Office of Markets.
13. Estimates of extent and average dates of seedtime and harvest throughout the United States, in cooperation with the Office of Farm Management.
14. Compilation showing geographic phases of prices of farm products in the United States, by States, in cooperation with the Office of Markets.
15. Compilation of wages of farm labor.
16. Estimates of the dairy industry, in cooperation with the Dairy Division of the Bureau of Animal Industry.
17. Chronology of agriculture of the United States, so much of this project as relates to agricultural history to be assigned to the Rural Organization Service.
18. Estimates of the potential agricultural area of the United States, in cooperation with the Bureau of the Census, Office of Farm Management, and the Bureau of Soils.

Other projects were either discontinued or transferred to other branches of the department.

(6) The committee also recommended that the number of classes of agricultural crops and their production to be considered by the Bureau of Crop Estimates should be increased as rapidly as possible in important areas.

TELEGRAPHING STATE REPORTS.

(7) For the prompt dissemination of crop estimates and forecasts of the bureau the committee recommended that the estimates be telegraphed on the date of issue to the field agent in each State. Upon reconsideration it was decided that it would be better to telegraph the estimates to the section director of the Weather Bureau in each State in order that the printing outfits of the station directors may be utilized for printing duplicate copies to be mailed to all the local newspapers in the State. This practice was inaugurated in the autumn of 1913 and is working very satisfactorily at minimum expense.

ISSUE OF THE AGRICULTURAL OUTLOOK.

(8) The Crop Reporter, formerly published by the Bureau of Statistics, having been discontinued in June, 1913, the committee on reorganization recommended that the tabular statements of crop estimates and other data of a statistical nature relating to agriculture be published monthly in a pamphlet of bulletin size to take the place of the Crop Reporter. In accordance with this recommendation the Agricultural Outlook was started in September, 1913, as a part of the Farmers' Bulletin series.

ISSUE OF THE WEEKLY NEWS LETTER TO CROP CORRESPONDENTS.

(9) The committee recommended also that the corps of selected county and township crop reporters of the bureau, comprising at least one farmer in every agricultural county and township in the United States, should be utilized to a greater extent than heretofore in the dissemination of information of interest to farmers. For this purpose the Weekly News Letter to Crop Correspondents was established in the summer of 1913, and in it are published timely articles on crops, plant and animal diseases, brief summaries of publications issued by the department, instructions as to obtaining information from the department, special instructions to crop reporters, announcements of various kinds relating to the work of the department, and similar information likely to be of special interest to farmers.

REORGANIZATION IN EFFECT JULY 1, 1914.

So far as it could be done without special legislation by Congress, the various changes recommended by the committee on reorganization were effected before the close of the fiscal year 1914 and arrangements were fully completed to make all further changes on July 1, the necessary authority having been granted by Congress in the act making appropriations for the new fiscal year, so that on that date the title of the bureau was formally changed to the Bureau of Crop Estimates, the force of State statistical agents was abolished, the titles of the former special field agents were changed, and a number of new field agents were appointed.

USE OF RURAL MAIL CARRIERS.

At the suggestion of the Assistant Secretary of Agriculture, and after careful consideration of plans and methods by the Interdepartmental Committee on Cooperation, it was decided to try to make an annual census of farms, acreages of farm crops, and numbers of livestock by means of the rural mail carriers. The Postmaster General and his assistants readily agreed to place the rural mail system of the Post Office Department at the service of this department. In order that the system under the new plan might be perfected in its details before applying it to the entire United States, it was decided to try out the scheme in the State of Maryland and in 15 counties in the State of South Carolina,

The first step in the campaign was to send a return postal card to all postmasters in Maryland and the 15 counties in South Carolina, asking them to report for each rural route the number of farms, the number of boxes, the number of families, and the number of patrons; also the number of farms not on rural routes served from the post office and the number of farms served by star-route carriers. These cards were mailed on November 15, 1913, and were returnable in five days. The information called for was desired to enable the department to estimate the number of schedules that would be required. On February 5, 1914, nearly three months after the first call on the postmasters for the required information, there were 44 Maryland postmasters and 26 of the South Carolina postmasters from whom no replies had been received.

On December 15 a supply of short, clearly worded farm schedules was mailed to all the post offices in Maryland and to all the post offices in the 15 counties in South Carolina, with a circular letter from the Fourth Assistant Postmaster General directing the postmasters to distribute the schedules among the rural and star route carriers, with instructions to leave them in all the rural mail boxes, to collect them later after they had been filled out by the farmers, and to follow up delinquent farmers and see that returns were made. Both the schedules and the envelopes containing them bore the printed request that they be filled out and returned within five days. The printed instructions on the short form of schedule which the farmer was asked to fill out contained a clear statement of the object of the inquiry and of the desire of the department to have him cooperate in supplying the information, with an explanatory statement to the effect that the information supplied would be regarded as strictly confidential and would not be used directly or indirectly

to increase his taxes. Notwithstanding these instructions and the precautions taken to insure compliance therewith, the returns came drifting in very slowly. On January 28, by which date the schedules had practically ceased to come in, the total number of schedules received was as follows:

Percentage of farm census schedules received.

State.	Filled out by farmers.	Filled out by mail carriers.	Total received.	Delinquent, no returns.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Maryland	27	11	38	62
South Carolina	12	19	31	69

The cost to the Department of Agriculture involved in obtaining reports from less than 40 per cent of the total farms in the States and counties named was estimated at approximately $1,000, including stationery, printing, duplicating, addressing, mailing, and sorting. This estimate does not include the cost of correspondence with individual postmasters. Approximately 40,000 schedules were received, making the cost to this department about $2.50 per 100 schedules. At the same rate it would cost this department alone more than $160,000 simply to secure returns from the 6,500,000 farms in the United States, and the cost of editing, tabulating, and summarizing the returns would probably amount to as much more. In view of this showing the experiment was abandoned.

The experiment seems to have demonstrated clearly that satisfactory results can not be secured without (1) a personal canvass and an actual enumeration by the rural mail carriers similar to that made by the census enumerator; (2) legislation making it compulsory upon farmers to supply the information requested; or (3) a long campaign through the press and other agencies to educate the farmers into the idea of furnishing information of a statistical nature regarding their business, primarily for their own benefit and incidentally for the benefit of others. Returns from less than 95 per cent of all the farms of a State would be of no value except as a basis for forming an estimate, yet this experiment has demonstrated that it would be extremely difficult and expensive to obtain returns from even 50 per cent of the farmers without education or compulsion of some sort.

ACCURACY OF CONDITION REPORTS.

The quantitative interpretation by the Department of Agriculture of condition reports of principal crops, except cotton, was begun in 1911. A review of these interpretations or forecasts shows that those made in June varied an average of 10.5 per cent from final yield estimates; those in July varied 9 per cent; in August, 6.3 per cent; in September, 3.8 per cent; in October, 3.3 per cent. Generally forecasts made one and two months before the harvest inquiry are very close to the final estimates of yield. The above percentages do not reflect the accuracy of the work of crop estimating, but rather reflect the variableness of conditions affecting growing crops, which is shown by changes which take place after the dates to which the condition

reports relate. The condition of a corn crop on August 1 may be normal with a forecast of 35 bushels per acre; but the crop may be practically ruined 10 days later by a devastating hot wind and the final yield be but 2 or 3 bushels per acre. The forecasts are such figures that, based upon average conditions in past years, there is an even chance or probability that the final yield will be either above or below the figure forecast. A variation of 10.5 per cent from the June forecast does not necessarily indicate an error of 10.5 per cent in the forecast, but rather indicates an average subsequent change in condition of 10.5 per cent before harvest.

The forecasts made during the last three years, together with final estimates of yield, are given below:

Final estimates of crop yields compared with forecasts made during growing season, 1911, 1912, and 1913.

Crop.	Forecast made in—					Final estimate.
	June.	July.	August.	September.	October.	
Corn (bushels):						
1911	.....	25.5	22.6	23.6	23.8	23.9
1912	.....	26.0	26.0	27.7	27.9	29.9
1913	.....	27.8	25.0	22.0	22.2	23.1
Winter wheat (bushels):						
1911	15.3	14.6	[1] 14.5	.....	.....	14.8
1912	14.1	13.9	15.1	.....	.....	15.1
1913	15.9	15.6	16.5	.....	.....	16.5
Spring wheat (bushels):						
1911	13.7	11.8	10.1	9.8	.....	9.4
1912	13.8	14.1	15.1	15.6	.....	17.2
1913	13.5	11.7	12.5	13.0	.....	13.0
All wheat (bushels):						
1911	14.7	13.5	12.8	12.6	.....	12.5
1912	14.0	14.0	15.1	15.4	.....	15.9
1913	15.0	14.1	15.0	15.2	.....	15.2
Oats (bushels):						
1911	27.7	23.2	23.2	23.9	.....	24.4
1912	29.3	30.1	31.9	34.1	.....	37.4
1913	28.8	26.9	26.8	27.8	.....	29.2
Barley (bushels):						
1911	24.9	20.9	19.8	20.3	.....	21.0
1912	25.2	25.6	26.7	27.6	.....	29.7
1913	24.4	22.8	23.1	23.1	.....	23.8
Rye (bushels):						
1911	16.1	15.5	15.6	.....	.....	15.6
1912	16.0	16.0	16.9	.....	.....	16.8
1913	16.5	16.1	16.3	.....	.....	16.2
Flaxseed (bushels):						
1911	.....	8.6	7.6	7.7	8.1	7.0
1912	.....	9.4	9.4	9.7	9.8	9.8
1913	.....	8.7	8.3	8.4	8.7	7.8
Rice (bushels):						
1911	.....	32.2	32.7	32.1	32.0	32.9
1912	.....	31.7	31.9	32.7	33.4	34.7
1913	.....	33.0	33.1	32.8	30.9	31.1
Potatoes (bushels):						
1911	.....	81.7	71.5	74.2	79.7	80.9
1912	.....	95.5	100.7	108.0	108.8	113.4
1913	.....	93.1	92.0	88.1	86.7	90.4
Tobacco (pounds):						
1911	.....	698.1	672.4	714.6	801.1	893.7
1912	.....	844.9	820.6	817.1	816.0	785.5
1913	.....	809.0	783.0	752.4	766.0	784.3
Hay (tons):						
1911	.....	1.10	1.14	[1] 1.09	.....	1.14
1912	.....	1.40	1.49	1.47	.....	1.47
1913	.....	1.33	1.33	1.31	.....	1.31
Buckwheat (bushels):						
1911	.....	.....	18.1	19.6	19.6	21.1
1912	.....	.....	19.3	21.3	21.4	22.9
1913	.....	.....	20.1	18.2	16.5	17.2

[1] Original estimate; the revised figure is slightly different.

INTERDEPARTMENTAL COMMITTEE ON COOPERATION.

The Interdepartmental Committee on Cooperation has held monthly meetings since its organization in October, 1913, and among the subjects formally considered are the following:

Method of handling cooperative projects partly completed by the Bureau of Statistics (Crop Estimates); new projects; revision of the statistical tables for the Yearbook; the utilization of rural mail carriers for an annual census of agriculture and live stock; the compilation of data showing the quantity and value of imports and exports of certain agricultural products from 1790 to 1913, most of which data have already been compiled in the Bureau of the Census, the Department of Labor, or the Bureau of Statistics (Crop Estimates) of this department; the compilation of a condensed abstract of census figures to be published in a pocket-size pamphlet for the use of employees in the field; the best method of taking over the work of estimating the wool production in the United States which for the last 25 years has been carried on by the National Association of Wool Manufacturers; index numbers for wholesale prices of textiles by the Bureau of Labor Statistics; the proposed collection of statistics on farm accidents by the Bureau of Crop Estimates; sources of information relating to meat production and consumption in the principal meat producing and consuming countries of the world, in connection with the special investigations of the committee appointed to study the economics of the meat situation; and the best method of securing estimates of the citrus and other fruit crops of the Mediterranean region.

BUREAU COUNCIL.

In the autumn of 1913 a bureau council was organized, consisting of the administrative officials and principal assistants of the bureau. Monthly meetings are held at which chiefs of divisions report on the condition of the work in their divisions, the statistical scientists report on the status of special investigations in their charge, and problems of administration and difficulties encountered in the work are discussed. These meetings are found to be especially valuable in bringing officials and employees together, creating a better understanding among them, keeping them in touch with the work of the bureau, and creating a spirit of cooperation which it would be difficult to secure otherwise.

INTERNATIONAL INSTITUTE OF AGRICULTURE AT ROME.

During the fiscal year the Bureau of Statistics (Crop Estimates) furnished monthly reports on acreage, crop conditions and estimated yields, and prices of live stock in the United States, also reports of exports and imports, to the International Institute of Agriculture at Rome. The periodical estimates of world crops furnished by the institute were promptly issued to representatives of the press of the United States through the Office of Information. In former years the Bureau of Statistics (Crop Estimates) was designated as the official channel of communication between the institute and the different branches of this department. This practice was changed in December, 1913, by the appointment of a special Committee on Relations with the International Institute of Agriculture, with the Director of the Office of Experiment Stations as chairman. At the request of the institute, and with the approval of the committee named, this bureau has agreed to inaugurate a system of estimating visible stocks of grain in the United States, which it is hoped can be done before the close of the present fiscal year.

MEETING OF SPECIAL FIELD AGENTS OF THE BUREAU AT WASHINGTON, D. C.

The 22 special field agents of the field service met with the bureau administrative officials at Washington, D. C., daily from 9.30 a. m. to 4.30 p. m. on four days, January 28 to 31, inclusive. The purpose of the meeting was mainly to make the agents acquainted with one another and with the bureau officials, to discuss the proposed reorganization of the field force, to outline to them the methods and policies of the bureau, to revise the instructions to the field force, and to consider special difficulties encountered by them in their work. The meeting was successful throughout. When they first met, but few of the agents were acquainted with each other or with the bureau officials. When the agents separated, it was with a feeling of mutual respect, friendship, and renewed zeal for the service, and the increased efficiency resulting from the conference has been apparent. The following program will indicate the character of the subjects considered:

Discussion and revision of instructions to special field agents.
Bases of crop estimates.
Securing and retaining the cooperation of an effective corps of aids or correspondents.
Cooperation with State and local officials and agencies for estimating acreages, crops, live stock, prices, etc.
The best method of estimating acreage.
Estimating numbers and classes of live stock.
Estimating special crops or products, such as apples, potatoes, peanuts, hives of bees, quantities of honey produced, etc.
Value of crop estimates to farmers.
Travel by special field agents; its various phases.
Office work of special field agents.
Special difficulties encountered by field agents.
Addresses by the principal officials of the bureau.

COOPERATIVE WORK FOR OTHER BRANCHES OF THE DEPARTMENT OF AGRICULTURE.

In accordance with the policy recommended by the reorganization committee, the organization and clerical force, equipment, and facilities of the Bureau of Statistics (Crop Estimates) for collecting and compiling information through its crop correspondents were utilized by other branches of the department during the fiscal year in connection with the cooperative projects which were reassigned, and other special inquiries, as follows: For the Office of Markets, estimates of stocks of cabbages and onions on hand in different sections; for the Rural Organization Service, inquiries relating to the business of making loans to farmers, and conditions and facilities for financing farm enterprises; for the Bureau of Animal Industry, inquiries relating to wool growing, sheep raising, geese, and prices paid for milk; for the Forest Service, statistics of the lumber industry, formerly handled by the Bureau of the Census; for the Bureau of Entomology, inquiries relating to the appearance of the locust in certain States; for the Office of Information, compilation of statistical data relating to area, acreage planted, crop production, and numbers, classes, and value of live stock, for each congressional district in the United States; for the committee appointed to study the meat situation, statistics relating to the world meat supply; and miscellaneous information for the Office of the Secretary, the Bureau

of Soils, the Advisory Committee on Finance and Business Methods, the Federal Horticultural Board, the Bureau of Chemistry, and the Interdepartmental Committee on Cooperation. The time of the clerical force involved in handling this cooperative work for other bureaus was considerable, equivalent to the time of 1 clerk for 3,964 days, or the entire time of 10 clerks for the fiscal year.

MATERIAL FOR PUBLICATION.

During the fiscal year the following manuscripts were prepared by employees of the Bureau of Statistics (Crop Estimates):

Field Agents' Handbook of Agricultural Statistics, a condensed statement of agricultural statistics of the Thirteenth Census, showing acreage, value, and relative importance of the different classes of crops and live stock for the United States and for each State.

First Aid Manual for Field Parties, by H. W. Barker, M. D.

Crimson Clover: Dates of Sowing and Harvesting, by James R. Covert.

Inland Boat Service, by Frank Andrews.

Cooperation Among the Roumanian Peasants, by E. T. Peters.

Movement from City and Town to Agriculture, by George K. Holmes.

Statistics of Sugar in the United States (Department Bulletin 66), by Frank Andrews.

Material and special articles for the Agricultural Outlook and the Weekly News Letter to Crop Correspondents.

CONCLUSION.

It is gratifying to note how generally the crop estimates of the bureau during the year have been accepted by the public as approximately correct. This is due largely to the patriotic service of the large force of voluntary crop reporters in every county and township of the United States, who serve without compensation other than the consciousness of a public duty well performed and such small recognition as can be extended to them by the bureau in the form of seeds and publications; to the zeal and efficiency of the trained field agents of the bureau, and to the faithful, efficient, and loyal service of the clerical force and administrative officials of the Washington office. It is hoped that with the increased appropriations granted by Congress for the fiscal year 1915, and with the force, equipment, and system of collecting information fully reorganized along the lines laid down by the reorganization committee, the crop estimating work of the bureau will become increasingly valuable.

REPORT OF THE LIBRARIAN.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE LIBRARIAN,
Washington, D. C., September 21, 1914.

SIR: I have the honor to submit herewith the executive report of the library for the fiscal year ended June 30, 1914.

Respectfully,

CLARIBEL R. BARNETT,
Librarian.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

The records of the library for the last fiscal year, as will be seen from the tables which follow, show an increase in the number of books and current periodicals received and also an increase in the use of the library. Certain parts of the current work, however, especially the cataloguing and the work with periodicals, were greatly interfered with by the loss of five assistants and by extra work in connection with the shifting of books in the stacks to provide extra shelving space. The ranges of library shelving throughout nearly the whole library were moved nearer together, leaving an aisle of 26 instead of 32 inches between the ranges, thus providing room for 20 additional double-face sections of shelving. The gaining of this extra space involved moving more than one-half the library three times.

That this moving, which involved a large amount of work and gained only a comparatively small amount of shelving space, would not have been undertaken if the need for space for the storage of books had not been imperative, will be evident. It was also realized that unless the congested condition of the library could be more adequately relieved in the immediate future its growth would be blocked and its efficiency seriously hindered. It was therefore a matter of special importance to the library when it was decided during the winter to move the library to a new eight-story office building to be erected on B Street near the corner of Fourteenth Street. The library will occupy the whole of the first floor and part of the basement, comprising in all approximately 11,900 square feet of space, and it is expected that it can be moved into the building early in the winter. Although the space for the library is not as large as it was hoped would be available, there are possibilities of obtaining additional adjoining space in the future, whereas in the present location this is impossible.

In the attempt to relieve the crowded condition of the library much more time than usual has been spent during the year in going over the collections and picking out books which it was thought need no longer be retained in the library. Large numbers of books have been discarded in previous years, but this work has been pushed more rapidly in the last few months, not only on account of the crowded condition of the shelves but also on account of the contemplated moving of the library. The number of books discarded during the year was 3,379.

Staff meetings were held each month from October to May. The scope of the meetings was broadened this year by including in them discussions of new policies and new lines of work undertaken by the department. To this end addresses at three of the staff meetings were made by the director of the Rural Organization Service, the chief of the Office of Markets, and the chief of the Office of Information.

As in previous years the library has received a large number of books, pamphlets, and periodicals by gift, the statistics in regard to them being contained in later paragraphs. It is regretted that space is not available each year for a complete list of the institutions, societies, publishers, and private individuals that have generously contributed to the resources of the library.

FINANCES.

A comparison of the receipts and expenditures of the library for the last five years is given in the following table:

Financial statement, fiscal years 1910 to 1914.

RECEIPTS.

Source of receipts and object of expenditure.	Fiscal year—				
	1910	1911	1912	1913	1914
Source:					
Library appropriation	$35,820.00	$35,320.00	$40,500.00	$41,280.00	$43,520.00
Allotment from department printing and binding fund	10,157.61	12,420.72	12,813.95	13,843.31	11,345.84
Total	45,977.61	47,740.72	53,313.95	55,123.31	54,865.84

EXPENDITURES.

Object:					
Books and serials	$10,278.45	$8,832.82	$7,290.95	$6,765.68	[1] $9,209.90
Periodicals	3,281.41	3,192.01	3,694.00	3,606.48	[1] 4,246.03
Index cards	191.77	224.44	146.89	215.86	168.03
Supplies and repairs	263.26	112.97	150.32	313.27	556.93
Furniture, shelving, and miscellaneous equipment	1,465.95	1,247.96	1,000.20	2,643.89	904.73
Traveling expenses	68.63	30.50	97.98	29.52	
Salaries (main library)	20,151.99	21,576.16	27,848.17	27,140.27	28,377.17
	35,701.46	35,216.86	40,228.51	40,714.97	43,462.80
Printing	3,982.35	3,676.34	3,307.54	4,084.21	1,892.25
Binding	6,175.26	8,744.38	9,506.41	9,759.10	9,453.59
	10,157.61	12,420.72	12,813.95	13,843.31	11,345.84
Total	45,859.07	47,637.58	53,042.46	54,558.28	54,808.64

[1] Approximate figures.

USE OF THE LIBRARY.

Books and periodicals charged by the main library and the bureau, division, and office libraries during the fiscal years 1913 and 1914.

Library.	Number of books charged—								Number of current periodicals charged.	
	To individuals.		To main library.		To branch libraries.		Total.			
	1913	1914	1913	1914	1913	1914	1913	1914	1913	1914
Main library	14,966	15,686	.....	.....	21,967	23,193	36,933	38,879	76,800	[1]87,000
Bureau of Chemistry library	7,405	8,646	1,327	846	61	69	8,793	9,561	19,166	20,681
Bureau of Entomology library	3,867	2,956	133	265	.....	50	4,050	3,271	515	890
Forest Service library	3,677	3,516	396	401	2	.....	4,073	3,917	2,206	2,915
Bureau of Plant Industry library	11,662	12,388	453	609	132	80	12,247	13,137	33,311	40,082
Dairy Division library	2,452	1,840	56	75	4	10	2,512	1,925	8,652	14,246
Office of Farm Management	([2])	2,287	([2])	3	([2])	2	([2])	2,287	.....	5,088
Office of Public Roads	([2])	1,354	([2])	57	([2])	20	([2])	1,458	.....	([2])
	44,029	48,673	2,415	2,247	22,166	23,404	68,608	74,425	140,650	170,902

[1] Approximate figures. [2] No records kept.

Statistics of circulation (main library), fiscal years 1913 and 1914.

Item.	1913	1914
Largest number of books charged on any day	203	214
Smallest number of books charged on any day	31	39
Largest number of books charged in any month	4,106	4,454
Smallest number of books charged in any month	2,269	2,083
Average number of books charged daily	121	126
Average number of books charged monthly	3,078	3,239

The statistics of circulation do not include a record of the books and periodicals used in the main library and in the bureau, division, and office libraries, but not charged at the loan desk. They also do not include a record of the use of the books filed in the libraries of the Bureau of Biological Survey, the Bureau of Statistics, the Office of Experiment Stations, and the Office of the Solicitor, all of which have collections of considerable size but keep no statistics of circulation.

In connection with the above tables attention is also called to the number of books charged to the main library by the bureau, division, and office libraries—namely, 2,247. These statistics show that it was necessary for the main library to recall this number of books from the bureau, division, and office libraries where they were deposited, in order to send them to other offices which wished to see them. The number is not unduly large in proportion to the total number of books used, and seems to indicate that the collections filed in the bureau, division, and office libraries are on the whole fairly well chosen with regard to their own needs and the needs of other bureaus.

INTERLIBRARY LOANS.

In the following tables are given statistics of interlibrary loans, including the records of the books borrowed by this library from other libraries and also the records of books lent by this library to institutions outside of Washington. In addition to the 896 books lent the library also supplied 17 typewritten copies and 47 photographic copies of articles desired for reference. Through the courtesy

of the Bureau of Animal Industry in allowing the use of its photostat machine the library is able to furnish photographic copies of articles in periodicals when they comprise only a few pages, thus avoiding the necessity of sending heavy volumes through the mail. It is hoped that it will be possible for the library to purchase a photostat machine in the near future, as there is an increasing need for this work.

Summarized statement of books borrowed from other libraries.

Item.	1913	1914
Largest number of books borrowed from other libraries on any day	43	40
Smallest number of books borrowed from other libraries on any day	1	1
Largest number of books borrowed from other libraries in any month	731	564
Smallest number of books borrowed from other libraries in any month	314	253
Average number of books borrowed from other libraries daily	18	16
Average number of books borrowed from other libraries monthly	480	432
Number of books borrowed during the year from libraries outside of Washington	91	62
Number of books borrowed during the year from other libraries in Washington	5,677	5,166
Total number of books borrowed from other libraries in and out of Washington	5,768	5,228

Detailed record of books borrowed from libraries in Washington.

	Number of books.
Army War College	2
Bureau of Education	31
Bureau of Ethnology	3
Bureau of Fisheries	17
Bureau of Foreign and Domestic Commerce	1
Bureau of Labor	7
Bureau of Railway Economics	2
Bureau of Standards	4
Department of Justice	2
Geological Survey	137
Hygienic Laboratory	6
Library of Congress	3,868
National Museum and Smithsonian Institution	205
Naval Observatory	1
Pan American Union	3
Patent Office	21
Public Library	29
Surgeon General's Office	805
Weather Bureau	22
Total	5,166

Detailed record of books borrowed from libraries outside of Washington.

	Number of books.
Arnold Arboretum, Jamaica Plain, Mass	7
Boston Public Library, Boston, Mass	4
Columbia University, New York, N. Y	2
Gray Herbarium, Cambridge, Mass	9
Harvard University, Cambridge, Mass	6
John Crerar Library, Chicago, Ill	4
John D. Smith Library, Baltimore, Md	11
Johns Hopkins University Library, Baltimore, Md	2
Lloyd Library, Cincinnati, Ohio	5
Massachusetts Horticultural Society, Boston, Mass	2
Museum of Comparative Zoology, Cambridge, Mass	4
Purdue University, La Fayette, Ind	1
University of Chicago, Chicago, Ill	1
University of Pennsylvania, Philadelphia, Pa	1
Yale University, New Haven, Conn	2
Zymotechnic Institute, Chicago, Ill	1
Total	62

Record of books lent outside of Washington during the fiscal years 1910 to 1914.

States, etc.	Fiscal year—					States, etc.	Fiscal year—				
	1909–10	1910–11	1911–12	1912–13	1913–14		1909–10	1910–11	1911–12	1912–13	1913–14
Alabama	.....	8	.....	.....	3	New Mexico	.....	.....	.....	1	4
Arizona	11	5	8	7	6	New York	91	70	79	59	113
Arkansas	.....	2	1	.....	.....	North Carolina	38	38	25	35	30
California	10	8	15	19	27	North Dakota	2	18	4	6	11
Colorado	4	7	15	9	12	Ohio	13	29	37	53	103
Connecticut	41	11	12	16	4	Oklahoma	.....	.....	.....	.....	1
Delaware	.....	5	8	11	18	Oregon	24	38	36	54	44
Florida	54	36	38	27	20	Pennsylvania	4	3	27	34	19
Georgia	7	4	7	1	14	Rhode Island	1	.....	.....	.....	1
Idaho	.....	.....	.....	3	5	South Carolina	.....	1	2	5	1
Illinois	16	11	2	6	12	South Dakota	.....	1	2	.....	.....
Indiana	2	15	23	7	7	Tennessee	9	13	9	16	26
Iowa	6	13	9	36	24	Texas	12	13	12	10	9
Kansas	2	2	18	8	12	Vermont	14	8	.....	27	30
Kentucky	3	11	2	6	4	Virginia	28	15	50	52	54
Louisiana	13	2	.....	5	2	Washington	6	.....	13	3	14
Maine	9	25	4	7	11	West Virginia	2	1	14	10	2
Maryland	8	8	9	12	7	Wisconsin	4	37	32	89	31
Massachusetts	8	17	10	14	18	Wyoming	6	7	.....	5	.....
Michigan	8	6	20	37	35	Canada	.....	1	11	2	.....
Minnesota	8	5	5	2	7	Hawaii	3	7	1	2	2
Mississippi	1	8	3	4	3	Japan	.....	1	.....	.....	.....
Missouri	4	1	5	17	19	Mexico	1	2	.....	.....	.....
Montana	3	2	2	15	13	Porto Rico	52	55	33	39	67
Nebraska	18	41	17	32	20	Canal Zone	.....	.....	.....	.....	1
New Hampshire	.....	1	.....	8	5						
New Jersey	2	1	.....	1	24	Total	548	613	620	826	896

ACCESSIONS.

The number of books, pamphlets, and maps added to the library during the fiscal year compared with the accessions of the four preceding years is as follows:

Accessions to the library for the fiscal years 1910, 1911, 1912, 1913, and 1914.

Accessions.	1910	1911	1912	1913	1914
Purchases:					
Volumes	1,454	2,030	1,552	1,321	1,548
Pamphlets	65	89	77	51	41
Maps	8	1	.....	1	1
Photographs	.....	.....	10	.....	.....
Serials and continuations	1,574	736	522	459	511
	3,101	2,856	2,161	1,832	2,101
Gifts:					
Volumes	488	614	907	886	719
Pamphlets	387	502	756	830	470
Maps	43	12	20	28	20
Continuations	2,728	3,463	3,560	4,425	4,490
	3,646	4,591	5,243	6,169	5,699
From binding periodicals and serials	1,409	1,369	1,718	1,573	1,826
Total	8,156	8,816	9,122	9,574	9,626

The total number of accessioned books and pamphlets contained in the library on July 1, 1914, was 133,046, an increase of 5,227 over the preceding year. The difference between the increase in the number of accessioned books, pamphlets, and maps—namely, 5,227—and the total number of accessions for 1914 as shown in the above

table is due to the fact that the following were not accessioned, that is, numbered with the accession stamp: Unbound pamphlets of less than 25 pages; unbound serials not of sufficient size to bind separately; volumes of periodicals in temporary binders.

CATALOGUING AND CLASSIFICATION.

There were classified and catalogued 2,267 volumes, 511 pamphlets, 6,827 continuations, and 21 maps, making a total of 9,626, an increase of 52 over the preceding year. There were added to the main (dictionary) catalogue 23,489 cards, and 2,864 were withdrawn, making the net addition 20,625, a decrease of 2,738 as compared with the preceding year. It is estimated that the main (dictionary) catalogue now contains approximately 306,000 cards.

The number of titles prepared by the library for printing by the Library of Congress in what is known as the "Agr" series of catalogue cards, compared with the fiscal years 1912 and 1913, is as follows:

Titles prepared for printing.

Item.	1912	1913	1914
Cards for accessions and recatalogued books	1,872	1,357	1,248
Cards for department publications	449	807	676
Cards for foreign agricultural periodicals	61	298	141
Total	2,382	2,462	2,065

The total number of titles prepared by this library since 1902, in which year the printing of cards was begun, is 25,446.

The amount of uncatalogued material on hand July 1, 1914—namely, 107 volumes, 555 pamphlets, 351 continuations, and 6 maps—was much greater than in the previous year. This was owing largely to the fact that the work of the cataloguing division during the year has been greatly hampered because of the loss of two assistants. The current cataloguing was also interrupted by work in connection with the reclassification of the botanical books. In this work of reclassification the library was generously assisted by the bibliographical assistants of the Office of Economic and Systematic Botany, Bureau of Plant Industry. Other classes of the library classification are also in need of expansion. It is hoped that considerable work along this line can be done during the present year, and that it will be possible to issue a revised edition of the complete classification in the near future.

In addition to the revision of the classification, considerable work was also done during the year in revising the subject headings in our catalogue to conform more nearly to subject headings in use by the Library of Congress.

PERIODICALS.

The total number of different periodicals, exclusive of annuals, received currently during the year was 2,128, of which 792 were received by purchase and 1,336 by gift. The increase in the number of periodicals received during the year, as compared with the preceding year, was 93. In order to facilitate the circulation of some of the periodicals, it was necessary to purchase 117 duplicates, making

the total number of periodicals purchased 909. Of the periodicals received by gift and exchange, over 750 duplicates were received, making the total number of periodicals handled currently during the year over 2,995.

MAILING LISTS AND EXCHANGES.

The library has charge of the bureau and office foreign mailing lists for publications of the department and also of certain miscellaneous foreign and domestic mailing lists. The number of addresses appearing on the various lists at the end of the year is shown in the table following:

Number of addresses on the mailing lists.

Class of lists.	Domestic.	Foreign.
Bureau and office lists:		
Bureau of Animal Industry		[1] 361
Bureau of Biological Survey		155
Bureau of Chemistry		189
Foreign Trade Journals		33
Bureau of Entomology		185
Bureau of Plant Industry		85
Bureau of Soils		163
Bureau of Statistics (Crop Estimates)		135
Agricultural Outlook		240
Forest Service		110
Office of Experiment Stations:		
Agricultural Education		35
Experiment Station Record		802
Farmers' Bulletin		50
Farmers' Institutes		34
Irrigation		7
Nutrition		184
Office of Public Roads		86
Federal Horticultural Board:		
Miscellaneous list		13
Shippers' list		583
Insecticide and Fungicide Board		16
Miscellaneous lists:		
Farmers' Bulletin	301	108
Monthly List	95	1,011
Yearbook	15	247
Institutions receiving all publications of the department	116	43
Journal of Agricultural Research		347

[1] Classified list. Not all the publications of the Bureau of Animal Industry are sent to the whole list.

In addition to the above lists, the library also maintains a consolidated list, arranged geographically, of all the addresses appearing on the various foreign lists. This consolidated list, which comprises approximately 3,700 addresses, is of great service in preventing duplication and in obtaining exchanges.

MISCELLANEOUS WORK.

The number of books and periodicals sent to the Government bindery was 3,362, a decrease of 176 as compared with the preceding year. In addition to the above books and periodicals, which were permanently bound, 1,402 were placed in temporary binders at the library, making a total of 4,824 bound.

During the year four lists of duplicate publications were sent out to the Library of Congress and the various agricultural colleges and experiment stations. The publications selected from these lists filled about 50 mail bags.

The number of letters translated during the year was 172, and the number of articles, 12.

BIBLIOGRAPHICAL WORK AND INDEXING.

In addition to the regular cataloguing described above, considerable progress was made during the year in the project undertaken by the main library a few years ago of indexing the reports and transactions of the State boards of agriculture and the State agricultural societies. About one-third of the collection has now been indexed. No bibliographical work of any great extent was done by the main library during the year, but a number of short lists of references on various subjects were prepared in answer to correspondence.

The more important bibliographical lists prepared by the bureau, division, and office libraries during the year were the following: A bibliography on the relation of the salt content of sea water to the physiology of marine animals and a select list of articles upon public slaughterhouses were prepared by the Bureau of Chemistry; the Forest Service library continued the work of preparing lists of current books and articles relating to forestry, which lists are printed each month in the American Forester; in the Office of Markets library various lists on the subject of marketing, especially cooperative and municipal marketing, were prepared; bibliographies were prepared by the Bureau of Plant Industry library on the subjects of infected grain, plant pathology, rice, rotation of crops, soil sterilization, analysis of sprayed fruits, and subsoiling.

In addition to preparing bibliographies on special subjects, several of the bureau libraries have also spent a considerable amount of time in editing and verifying lists of bibliographical references accompanying bulletins published by their respective bureaus. The number of bibliographies verified by the various bureau libraries during the year is as follows: Dairy Division, 8; Bureau of Entomology, 9; Bureau of Plant Industry, 74.

BUREAU AND DIVISION LIBRARIES.

In the present report of the library, as in the reports for the last two years, it has seemed best, on account of limited space, to omit the detailed reports of the various bureau, division, and office libraries on their regular routine work, and instead to incorporate their statistics with those of the main library. The approximate strength of the various bureau libraries at the present time is given in the following table:

Books, pamphlets, and periodicals in bureau libraries.

Name of library.	Librarian.	Approximate number of books and pamphlets.	Number of periodicals currently received.
Bureau of Animal industry	Miss Elsie Moore	[1]	
Bureau of Biological Survey	Mr. W. H. Cheesman	7,500	65
Bureau of Chemistry	Miss Anne E. Draper	11,500	400
Bureau of Statistics (now Bureau of Crop Estimates).	Miss Louise Hayward	10,000	335
Bureau of Entomology	Miss Mabel Colcord	13,500	98
Forest Service	Miss Helen E. Stockbridge	17,700	67
Bureau of Plant Industry	Miss Eunice R. Oberly	6,600	753
Dairy Division	Miss Margaret Doonan	2,065	324
Office of Experiment Stations	Miss E. Lucy Ogden	4,300	[2] 600
Office of Farm Management	Miss Cora L. Feldkamp	6,000	285
Office of Markets	Miss Caroline B. Sherman	430	86
Office of Public Roads	Mr. W. W. Sniffin	9,000	88

[1] No separate library collection maintained. [2] Approximate figures.

During the year the physical status of the Bureau of Statistics library was entirely changed. Additional library shelving was added, and the books on the shelves were moved and rearranged more nearly in accord with the system used in the main library. Additional shelving space was also acquired by the Bureau of Entomology.

New appointments of bureau librarians during the year were: The librarian of the Bureau of Biological Survey; the librarian of the Bureau of Statistics; the librarian of the Office of Markets; and the librarian of the Dairy Division. The Office of Markets was created May 16, 1913, and branch library work for the office was begun on November 15 of last year. The librarian appointed was formerly librarian of the Dairy Division.

REPORT OF THE DIRECTOR OF THE OFFICE OF EXPERIMENT STATIONS.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., September 16, 1914.

SIR: I have the honor to present herewith the report of the Office of Experiment Stations for the fiscal year ended June 30, 1914.

Respectfully,

A. C. TRUE, *Director.*

Hon. D. F. HOUSTON,
Secretary of Agriculture.

INTRODUCTION.

The work of the Office of Experiment Stations during the year ended June 30, 1914, as heretofore, has included (1) relations with agricultural experiment stations; (2) relations with institutions for agricultural education; (3) maintenance of experiment stations in Alaska, Hawaii, Porto Rico, and Guam; (4) irrigation investigations; (5) drainage investigations; (6) nutrition investigations; and (7) preparation of publications relating to all the foregoing lines of work. During the latter part of the year the work of the office was materially broadened and increased as a consequence of the passage of the agricultural extension act of May 8, 1914, and additional duties connected with the new policy of the department which aims at a more definite coordination of its work in the several States with the similar work of the State agricultural colleges and experiment stations.

RELATIONS WITH AGRICULTURAL EXPERIMENT STATIONS.

The close relations which have heretofore existed between the office and the agricultural experiment stations in the several States were maintained during the year. As required by law, supervision was exercised over the Federal appropriations provided by the Hatch and Adams Acts, involving not only an inspection of the work and expenditures of the stations under these acts, but a critical examination of the projects for research, with suggestions, and their approval prior to the expenditure of funds upon them. A report on the results secured in the field of agricultural investigation, and on the different lines of work in progress at the stations, together with the total revenues and the use made of the Federal funds, was prepared for publication.

As heretofore, the office advised with the stations in reference to the development of their work, their personnel, and questions of

efficient administration and management. Special attention was given to the matter of organization and to a differentiation of the station work proper from the various forms of extension activity. Larger emphasis on this differentiation grew out of the preparation for inaugurating separate divisions of extension in all the colleges under Federal aid. In the past very many things have been done in the name of the stations which did not really come within their function. Insistence has now been laid upon a clearer definition of function and of action, as far as the Federal funds are concerned, and upon an organization and administration which will effectually promote the work of investigation and experimentation and preserve the station funds to that use. Through its correspondence, its publications, and its more direct relations the office has sought to stimulate thoroughgoing investigation, to defend the position of those engaged in such work, and to secure wider recognition for it.

In several of the States the relations with the boards of control have been closer than ever before, conferences being held or stated meetings of the boards attended to discuss courses of action and general policy in relation to the stations.

The experiment stations as a whole made good progress during the year in the development of their work and in the maintenance of high standards, and their general condition has been most satisfactory. The growth of appreciation by the Commonwealths which they serve is evidenced by the increased financial support given to supplement the Federal funds. The total income of the stations for the year ended June 30, 1913, was $4,387,635.46, of which $1,440,000 represented the appropriations under the Hatch and Adams Acts and $1,540,133 the amount received from State appropriations.

The activity of the office in its relations with the experiment stations was in special charge of the assistant director, with the aid of Mr. W. H. Beal, Dr. W. H. Evans, and Mr. J. I. Schulte.

RELATIONS WITH INSTITUTIONS FOR AGRICULTURAL EDUCATION.

As heretofore, the educational work of the office has been along two main lines—(1) that relating to agricultural colleges and schools and (2) that relating to farmers' institutes and other forms of extension education in agriculture.

AGRICULTURAL COLLEGES AND SCHOOLS.

During the year an effort has been made to establish a more definite and permanent policy with reference to the educational work of this office. The period of propaganda for the establishment of institutions and courses devoted to agricultural instruction has about come to an end. The main problems now relate to the effective organization of this work and the supplying of up-to-date subject matter and illustrative material in proper form for use in the schools.

Wherever the work of the office touches questions relating to the general organization and work of the schools comprising our educational system or the general progress of agricultural education cooperation with the Bureau of Education is sought. Arrangements have been made to cooperate with this bureau in the preparation of an annual report on the progress of agricultural education at home

and abroad, including the statistics of the agricultural colleges, to be published by the bureau.

Cooperative arrangements have also been made with the other bureaus of the Department of Agriculture for the preparation of subject matter for use in the schools. There have also been cooperative relations with State agricultural colleges, experiment stations, and departments of education.

A definite beginning was made in the preparation of illustrative material for use in agricultural schools, including charts, photographs, lantern slides, etc. Exhibits of such materials were prepared for use at teachers' institutes and other educational meetings.

One of the important problems which has recently developed in agricultural education is the use of land in the teaching of agriculture in secondary schools. The office therefore undertook during the year to study this special problem in agricultural education in cooperation with the American Association for the Advancement of Agricultural Teaching. The problem in agricultural education studied in cooperation with the Association of American Agricultural Colleges and Experiment Stations was advanced farm practice as it is insisted upon for graduation by agricultural colleges.

Studies were begun of the content of courses of instruction in home economics, with special reference to their development in relation to the betterment of rural homes, and to agricultural conditions and products found in the environment of the schools.

The office endeavored to aid in the organization and development of various forms of juvenile agricultural club work.

Card indexes of the world's literature of agricultural education, as well as of American and foreign institutions for agricultural education and instruction in home economics, were maintained by the office.

This division of the work of the office was in charge of Mr. C. H. Lane, chief specialist in agricultural education.

FARMERS' INSTITUTES AND AGRICULTURAL EDUCATION EXTENSION.

The office aided the extension departments of the agricultural colleges, the State departments of agriculture, the agricultural high schools and other schools teaching agriculture, the county agricultural demonstrators, railroad departments of agriculture, and numerous local organizations in their extension work in agriculture and home economics among rural people.

Information respecting agricultural extension work at home and abroad was collected and published, and improved extension methods studied; lectures and addresses were also given, and personal conferences held with extension workers. Agricultural literature and illustrative material to aid extension teachers in the more effectual presentation of their subjects formed a conspicuous part of the aid given, and the demand for such aid greatly increased over that of any previous year.

Movable schools in agriculture and home economics have met with hearty approval among extension departments, and seem destined to become one of the chief methods of extension teaching. A special form of such schools devised by this office, with a view to supplementing the limited supply of trained instructors by using the best available local talent as leaders of small classes under the general

supervision of experts from the agricultural colleges, has been tried experimentally during the year and will be further tested the present year.

There is now much discussion as to the place which farmers' institutes should have in the general scheme of extension work, and what changes are necessary to adapt them more fully to the new organization of the extension work of the agricultural colleges under the Smith-Lever Extension Act. This office is making a study of this problem, and for this purpose is keeping in close touch with State organizations for such work.

It is planned to bring the work of the office relating to farmers' institutes and other forms of extension work into close relations with the new department organization for administering the Smith-Lever funds and carrying on demonstration and extension work in the several States in cooperation with the agricultural colleges.

Great activity was manifested in all forms of agricultural extension work both in agriculture proper and in home economics throughout the United States during the last year. There was a marked increase in efforts to reach young people and women through special forms of itinerant instruction.

Statistics showing the extent and progress of farmers' institute work are not yet available for all the States, but the 45 States thus far reporting expended the sum of $426,447.50 during the year for farmers' institutes, and 3,769,478 persons were in attendance. Likewise, statistics showing the extent and progress of agricultural extension work other than farmers' institutes, but not including the demonstration or other extension work carried on by the Federal Department of Agriculture, are not available for all the States, but the 42 States thus far reporting expended the sum of $1,687,552.14 during the year for this work, and 4,010,835 persons received instruction. Agricultural education extension work in all its phases as carried on by the States thus far reporting, but exclusive of the great extension work conducted by the Federal Department of Agriculture, involved the expenditure of $2,113,999.64 and the instruction of 7,780,313 persons during the year in agricultural subjects by extension methods.

This division of the work of the office remained in charge of Mr. John Hamilton, as farmers' institute specialist, until his resignation January 1, 1914. Mr. Hamilton was succeeded by Mr. J. M. Stedman.

PUBLICATIONS OF THE OFFICE.

The publications of the office during the year comprise 53 documents, aggregating 3,701 pages, and including 18 numbers of Experiment Station Record, 2 reports, 6 technical bulletins, 4 Farmers' Bulletins, including one number of Experiment Station Work, 14 publications of the insular stations, 1 Yearbook article, 7 separates, and 1 miscellaneous document. The number of new publications, excluding separates, was 46, containing 3,309 pages, as compared with 70, containing 5,405 pages the preceding year.

There was a decided increase in the number of publications of the insular stations, but the printing of monthly lists of station publications and of the Experiment Station Work series of Farmers' Bulle-

tins was discontinued. There was little change in the general character of the publications.

Volumes XXIX and XXX of Experiment Station Record, each consisting of nine numbers and the usual author and subject indexes, were prepared during the year, in accordance with the general plan in operation for several years. These volumes contained 7,960 abstracts of the world's scientific literature pertaining to agriculture, together with monthly editorials discussing important phases of the development of agricultural investigation and science, and brief notes on the progress of institutions for agricultural education and research in this country and abroad.

The great function of such a journal as the Record is to accumulate, classify, and make ready of access the knowledge which the world is gaining through the steady current of advancing agricultural science. Such a function is a large and responsible one, and the continued growth in the amount of agricultural investigation makes the prompt issue of the material in the present available space a difficult matter. It is probable that the maximum has been reached under present conditions. If the Record is to keep pace with the constantly expanding volume of the literature, its facilities must ultimately be enlarged and extended.

Other publications of the office included reports on the work and expenditures of the State agricultural experiment stations and on the work of the experiment stations in Alaska, Hawaii, Porto Rico, and Guam; statistics of the land-grant colleges and experiment stations; proceedings of the Atlanta meeting of farmers' institute workers; farmers' institute and agricultural extension work in the United States, 1913; training and reading courses in agriculture for teachers; collection and preservation of plant material for use in the study of agriculture; cooperative irrigation experiments at the California University farm at Davis; water supply, plumbing, and sewage disposal for country homes; drainage of the wet lands of southern Louisiana; use of corn, Kafir, and cowpeas as human food; corn meal as human food; ways in which the Department of Agriculture aids the housekeeper; and the homemade fireless cooker.

The publications of the insular stations included bulletins on the effect of heat on Hawaiian soils, rice soils of Hawaii, the papaya in Hawaii, organic nitrogen of Hawaiian soils, tobacco insects in Hawaii, acid and red-clay soils of Porto Rico, and Porto Rican beekeeping, besides annual reports covering the various lines of work of the stations in Alaska, Hawaii, Porto Rico, and Guam.

The editorial management of the Record remained in charge of Dr. E. W. Allen, with Mr. H. L. Knight as assistant editor. The other publication work of the office was in charge of Mr. W. H. Beal.

WORK OF STATES RELATIONS COMMITTEE.

In consequence of the passage of the agricultural extension act of May 8, 1914, the administration of which is given to the Secretary of Agriculture, a committee was appointed by the Secretary to carry on the business connected with this act. Since this act provides for cooperative relations between the department and the State agricultural colleges in demonstration and extension work in agriculture and home economics, it was deemed highly desirable to coordinate all the work of the different bureaus of the department in these lines

with similar work of the agricultural colleges and to enter into general cooperative arrangements with the colleges, under which the department would work through them in all its extension activities. The committee was therefore intrusted with the making of such arrangements and was designated the States Relations Committee. Its members are the Director and Assistant Director of the Office of Experiment Stations and the two officers of the Bureau of Plant Industry in charge of farmers' cooperative demonstration work, Messrs. C. B. Smith and Bradford Knapp. A memorandum of agreement between the Secretary of Agriculture and the presidents or deans of the agricultural colleges has been drawn up and has already been adopted in most of the States. The assent of all the States to the provisions of the agricultural extension act has been obtained and an organization for the administration of funds granted to the agricultural colleges under this act, as well as of the other funds intrusted to those institutions for extension work, has been formed in all the State colleges. These organizations practically establish divisions of agricultural extension in the colleges, which resemble and are coordinate with the agricultural experiment stations and have at their head directors of extension work corresponding to the directors of the experiment stations. Through the extension divisions of the colleges a large number of projects for cooperative extension work in a great variety of lines have been formulated and agreed upon under the general memorandum of agreement.

OTHER COMMITTEE WORK.

On the recommendation of the Secretary of Agriculture the director of the office was one of the delegates sent by the United States through the State Department to the general assembly of the International Institute of Agriculture held at Rome, Italy, in May, 1913. An arrangement was afterwards made with the State Department for the conduct of the business of this department relating to the institute directly with the permanent delegate of the United States at the institute. To provide for the regular transaction of such business the Secretary appointed a committee on relations with the institute, consisting of the director of this office and Messrs. Fairchild and Swingle, of the Bureau of Plant Industry. This committee has kept in close touch with the institute and has transacted a considerable amount of business relating to its affairs.

As a member of the editorial committee of the Journal of Agricultural Research and of the advisory committee on the projects of the department the assistant director of this office has done a large amount of work.

INSULAR STATIONS.

Investigations carried on at the several stations made satisfactory progress during the year. Few changes took place in the personnel, and as a consequence the work proceeded uninterruptedly along the various lines that have been pursued for some years.

So far as possible investigations have been of a research nature, but in the choice of problems to be studied those that have an immediate bearing on agriculture always have precedence. Some of these research studies have been carried far enough to show some very practical bearings, and the results are being widely disseminated

through publications, cooperative experiments, and demonstrations. The scientific data are being published through technical publications.

The relations of the several stations with those for whom they are maintained continue to be very cordial. Increasing local support, the desire for cooperative experiments, and requests for publications and individual advice all attest the esteem in which the stations are held. In Hawaii the legislature appropriated $15,000 for the demonstration and marketing work that was carried on during the past year, and local contributions exceeding $1,500 were available for investigations. In Porto Rico an appropriation of $5,000 was made for a new plant laboratory, making about $30,000 that has been contributed by the insular government for the erection of buildings within the last four years. These sums, together with the sales funds, have very materially aided in extending the work.

The appropriations for the insular stations for the year ended June 30, 1914, were for Alaska, $35,000; Hawaii and Porto Rico, $30,000 each; and Guam, $15,000. These sums were increased by sales and other funds as follows: Alaska, $12,740.79; Hawaii, $19,516.27; Porto Rico, $2,699.85; and Guam, $273.64. These sums were available for the maintenance of the stations and the extension of their work.

The administrative work of the stations in relation to this office and the review of their fiscal affairs continue, as formerly, under the charge of Dr. Walter H. Evans and the accounting division of this office.

ALASKA STATIONS.

The climatic conditions in the interior of Alaska during the latter part of the summer of 1913 were not as favorable as in 1912, but most of the grains were ripened. Frost came earlier in 1913 than ever before known, and a killing frost covered a large portion of the interior of the country during the last days of August. The winter of 1913–14 in the interior was not severe, but, on account of the light snowfall, fall-sown crops were severely injured.

At the Sitka station attention is still given to the improvement and propagation of small fruits. The work with hybrid strawberries is progressing favorably. Of the new hybrids several hundred fruited this year for the first time, and one matured its fruit 10 days earlier than any native or cultivated variety. Attention is being given to the crossing of varieties of wild and cultivated currants and gooseberries, as well as the berries belonging to the genus Rubus. Attempts are being made to cross the native wild crab apple by using pollen from cultivated varieties of apples. Tests are being made of potatoes, cabbage, cauliflower, turnips, radishes, and other vegetables to determine the varieties best suited to the climate, the experiments being conducted on a scale sufficiently large to determine the adaptability of different varieties.

At the Rampart station the grain-breeding work and experiments with forage plants are being pushed as rapidly as possible. During the year Grimm alfalfa was found to seed abundantly. Nearly all the alfalfa and sweet clover seeded during the summer of 1913 was winterkilled, but of the old plants of Grimm alfalfa and of *Medicago falcata* only an individual here and there was destroyed. The plant

breeding was considerably extended during the season by reason of the presence of a trained assistant. The possibility of producing locally grown seed of various garden crops was shown at Rampart, where seed of turnips, radishes, peas, and other vegetables were fully matured.

The Fairbanks station is largely devoted to demonstration work in crop growing and in soil management. In spite of the unfavorable weather, one variety of winter wheat, two of winter rye, two of spring wheat, four of barley, and all the early varieties of oats were fully matured. The experiments with potatoes at this station continued satisfactorily. The importance of sprouting tubers before planting was again demonstrated. More than $800 worth of station-grown tubers were sold to farmers and others for planting during the spring of 1914. Some experiments in raising hogs have been begun.

The experimental work at Kodiak during 1913 showed the possibility of revegetating the land covered by ash from Mount Katmai, and the Galloway cattle have been returned to the reservations on that island. The experiments last year showed that wherever nitrogen is added to the volcanic ash or where the lower rich soil is mixed with the volcanic ash excellent crops can be raised. A plow has been devised at the station that will mix the ash and soil, and it is believed that no trouble will be experienced in growing crops sufficient to maintain the live stock.

HAWAII STATION.

The soil investigations at the Hawaii station, which are primarily of a research character, have already given results of great practical value. It has been found that in the heavy clay soils commercial fertilizers, used alone or in mixtures, check the movement of water in all directions. Nitrate of soda increases the water-holding power of such soils and at the same time reduces the capillary rise of moisture. Phosphoric acid has been found to be fixed by Hawaiian soils to a greater extent than any other fertilizer constituent, but it continues available for plants as shown by its residual effect. Nitrates are not fixed to any appreciable extent by Hawaiian soils, but ammonia is fixed to some degree. There is found to be less loss from fixation in soils where fertilizers are applied singly than in combination. Practically no nitrification was found to take place in fallow land in Hawaii, but heat and volatile antiseptics increase ammonification for a few weeks, after which nitrification proceeds rapidly.

In agronomy a number of lines of investigation are in progress. A variety of rice, Bezembo, has been obtained from Japan that is fully 10 days earlier than any variety of rice that has been grown at the station. It has been found that cultivating soy beans as a green manure crop in connection with rice has nearly doubled the yield of the latter crop. The fourth crop of Caravonica cotton was harvested during the year. The plants had not been fertilized or replanted for four years, but are cut back each season. The yields per acre for the four years have been 150 pounds, 630 pounds, 425 pounds, and 418 pounds for the respective years. By the picking and destroying of the infested bolls the amount of infestation of the pink

bollworm has been reduced to about 6 per cent. About 70 species of soiling and pasture plants have been introduced and partially tested by the station. Some of these give great promise of value. Sudan grass yielded 61 tons of green forage per acre from two cuttings. Experiments are in progress in growing flax, corn, buckwheat, potatoes, etc.

The horticultural work with papayas has resulted in the production of a strain that gives more than 95 per cent perfect flowering trees, thus practically eliminating the undesirable staminate trees. Observations on mangoes show that seedlings require six and one-half years to come into fruit bearing, as compared with two and two-thirds years when budded. Seedling avocados require about seven years to come into bearing, while only three years are required for budded trees.

In its effort to diversify agriculture the station has aided in developing a number of new industries. Among these is the production of algaroba bean meal, the production of which was last year valued at $350,000, as well as the establishment of a plant for the production of kukui oil, for which there is a good demand on the mainland.

The Mediterranean fruit fly, which has proved such a pest, has been found to attack coffee while the berries are yet on the trees. Investigations have shown that earlier picking will give a better flavored coffee with little loss due to the fruit fly. It has also been found practicable to place paper bags about fruits to protect them against this pest. Some recent experiments have indicated that cold storage will destroy the fruit fly in any stage of existence in avocados, papayas, figs, water lemons, etc., if the fruit is kept for a period of 10 days or more at a temperature of 32° F. For most of these fruits storage at this temperature improves their quality.

The work at the substations continues to give useful results.

The cooperative-marketing investigations financed by a Territorial appropriation have given results far in excess of expectations. A marketing division for the handling of farm products raised on the islands was established July 1, 1913. The first month's receipts were valued at $84, but they have increased since that time to an average of $6,000 a month. The total value of all products handled during the year was $26,500, and the cost of marketing them was about $2,000. This has led farmers on the islands to produce more vegetables, fruit, poultry, eggs, etc., and they are kept informed by weekly circular so that there will not be a glut in the market.

PORTO RICO STATION.

Agriculture in Porto Rico is said to be undergoing two important changes—diversification and readjustment—due to changed economic conditions. In the diversification of crops the station has played an important rôle through its investigations, indicating what crops are suited to different climatic and soil conditions of the island.

In the change from extensive sugar planting attention is now being turned to fruit growing, which in a dozen years has increased in exports from a few thousand dollars to several millions. The station is conducting a survey of the island to determine which sections are best adapted to fruit growing, and experiments are in progress on methods for improving the fruit industry in every way. The grow-

ing of improved mangoes is being pushed, and several thousand cultivated trees have been distributed to different sections of the island. Especial attention is being given to the cultivation of the coconut and other tropical nuts. Experiments with coffee have been considerably extended.

The propagation and distribution of better varieties of cacao is being continued, and studies on the proper curing of the crop are in progress. Several years ago the station introduced vanilla culture to the island, and a practical test of this industry is being made, a large number of cuttings having been sent out to different parts of the island.

The work in forestry has been extended during the year, and about 200 acres of plateau land near the station have been planted to eucalyptus, rubber trees, cabinet woods, nut-bearing trees, etc.

In field crops the station has been working in cooperation with the planters to secure proper systems of rotation and fertilization to be adopted in sugar-cane cultivation. Especial attention is being given to the growing of leguminous forage crops, Japanese clover, and several of the sword or jack beans having thus far proved the most promising.

The introduction and breeding of improved live stock is continuing as formerly and some work in dairying under tropical conditions has been begun. A study of the rôle of mineral nutrients, especially lime, in animal nutrition is in progress.

Several important lines of work relating to soil fertility and plant nutrition were carried on by the chemist.

The plant pathologist is making a study of the diseases of economic plants, especially of coffee, citrus fruits, cacao, coconuts, and bananas, and he has prepared for publication a bulletin on coffee diseases in Porto Rico.

The life history of the changa, or mole cricket, is being further studied by the entomologist, with the hope that some means of combating it may be found. Other studies are in progress on the insects affecting coffee and the leguminous trees used for coffee shade. The former investigations on apiculture have been continued, and in cooperation with the Bureau of Entomology of this department a bulletin on Porto Rican beekeeping has been issued. This industry was begun about six years ago by the station, and it has developed until the exports of the seven months ended January 31, 1914, were valued at over $68,300.

An appropriation of $5,000 by the insular legislature has made possible the construction of a plant laboratory in which experiments can be carried on under controlled conditions. The old sugar-mill building has been reconstructed into a soils laboratory and the pressing needs of the station for room have been met.

GUAM STATION.

The work of the Guam station has been largely in continuation of that previously reported. During the year an additional tract of land was purchased to produce pasture and forage necessary for the rapidly increasing live stock. A considerable area of rough land was included in the tract purchased, but it can be used for experiments in forestry, range, etc.

The success of the experiments on the introduction of improved live stock has been fully demonstrated. A number of pure-bred animals have been born, and the young grade stock now on the island is reported as being greatly superior to the native stock. The people are taking an active interest in this experiment. There have been some losses among the cattle and pigs, due to disease, and it is highly desirable that additional breeding stock be secured as soon as possible. The poultry work has been quite interesting and successful.

The experimental work with the field crops has been reduced somewhat on account of the necessity of growing forage for the stock. Practically all the forage needed has been grown on the station lands.

In connection with the forage-plant investigations, Para grass and *Paspalum dilatatum* have given good results so far as pasture and soiling crops are concerned, but there is need of a more nitrogenous crop to supplement the grasses, and for this purpose peanuts appear to be the most promising.

The introduction and improvement of tropical horticultural plants is being continued as rapidly as possible. Special attention is being given to the methods of propagating and to distributing improved mangoes.

The work with bees has been actively taken up, and 2 colonies, which belonged to the station in December, 1912, increased to 15 colonies within a period of seven months.

IRRIGATION INVESTIGATIONS.

During the year just passed more attention than formerly was given to scientific and technical studies, while the preparation and publication of popular reports describing irrigation conditions and irrigation practices was continued.

The scientific studies made during the year have dealt chiefly with the relation of quantity of water used and time of use to quantity of crop produced. A comprehensive study of the quantities of water used in field practice in Idaho was completed, and a report on this study, which extended over several years, is being prepared for publication.

Technical investigations made during the year have dealt largely with the conveying and measuring of water.

An attempt to apply in practice the facts developed as to the best quantities of water to use necessitates the measurement of the water used, and consequently considerable attention has been given to this subject. Very satisfactory progress was made at the hydraulic laboratory at Fort Collins, Colo., an extensive series of tests of measuring weirs being carried out. The Fort Collins experiments have covered much wider ranges than the experiments upon which existing formulas are based and have resulted in the development of new formulas and tables computed from these formulas, which are more accurate than those in common use and at the same time extend considerably the range of discharges which can be accurately measured by weirs of various sizes. Experiments with other types of measuring devices are being made.

During the year a comprehensive study of the methods of lining irrigation canals with concrete was made, and a report was prepared and submitted for publication.

Studies of methods of pumping and the possibility of obtaining water for irrigation at a reasonable cost by pumping from wells have been continued.

The demand for advice as to methods of applying water to truck and fruit crops in the humid portions of the country is constantly becoming greater, and the work in those sections has increased during the last year.

Studies of the operation of irrigation district laws, the Carey Act, and other laws designed to promote irrigation development; of the causes of financial failure of irrigation enterprises, and of the organization and operation of cooperative irrigation enterprises have been continued during the year.

At the request of the Secretary of the Interior and of local interested parties, the office has undertaken a determination of the effect of the storage of the flood waters of the North Platte River in the Pathfinder Reservoir in Wyoming on the ground-water level in the Platte Valley in central Nebraska. Several lines of wells extending across the Platte Valley have been put down, and observations of fluctuations in the level of the ground-water are being made.

The irrigation investigations remained in direct charge of Dr. Samuel Fortier.

DRAINAGE INVESTIGATIONS.

During the year the office extended its work so as to include investigations in 36 different States, the entire time of 30 commissioned engineers having been devoted to the field and office duties. As in the last several years, the scope of the investigations included the preparation of plans for the improvement of farm lands under cultivation but which do not yield maximum returns owing to poor natural drainage; the reclamation of swamp lands; the protection of lowlands from overflow of streams; and studies of methods to reclaim land in the arid regions which has become waterlogged or alkaline.

In the Southern States, increased interest is being manifested by farmers in improving their land by the installation of underdrainage systems and terraces. Particular attention is being given to this phase of drainage in the Piedmont sections in North Carolina, South Carolina, and Georgia. From the tile drainage systems which were installed in the black prairie section in Alabama several years ago for experimental purposes valuable data are being obtained as to spacing and depth. Data showing results derived from properly constructed underdrains are also being secured. Plans were prepared for the underdrainage of two large representative farms in Loudon and Shenandoah Counties, Va., and the drainage systems will be installed under the supervision of this office. Great interest in this kind of work is being taken in Maryland, Mississippi, Alabama, Arkansas, Kentucky, and Texas. Demonstrations of tile drainage construction methods and the use of tiling tools were made at various meetings of farmers in Maryland, Delaware, North Carolina, and Mississippi. A report on land drainage in Maryland has been prepared for publication by the State experiment station.

Surveys and plans for the protection from overflow of about 150,000 acres of bottom land along the Big Black River, Miss., have been completed. A survey of approximately 50,000 acres of swamp and wet land in Orangeburg County, S. C., was commenced. Drainage

plans were completed for 24,000 acres of overflowed land in Henderson and Union Counties, Ky.; for 5,000 acres of swamp land in Beaufort County, N. C.; and for 40,000 acres of overflowed bottom lands along the Red River, Lafayette County, Ark. A study of drainage conditions in Florida was also begun.

The investigations in the wet prairie sections of southern Louisiana continued during the year. The data relating to this section which had been collected in previous years were issued as Department Bulletin No. 71. A map showing the area, location, and progress of all drainage districts in southern Louisiana was distributed. Data relating to run-off from drained areas and the cost and operation of drainage pumping plants in Louisiana were compiled and distributed. Tests for determining the efficiency of various types of pumping equipment were made at four drainage pumping plants.

Run-off investigations were continued in North Carolina, Georgia, Mississippi, and Arkansas, and additional gauging stations were established in Louisiana and Texas.

A study was begun in the spring of 1914 to determine the effect of tile drains on the temperature of the soil as compared with untiled land. The collection of data showing the discharge from tile drains was commenced in several States. Investigations relating to the construction, maintenance, and cost of drainage works were continued. Reports giving the results of studies of various types of excavating and trenching machines were completed.

In the irrigated sections, exclusive of several projects for which surveys and plans for drainage were made, the work during the year assumed more of a research character. Studies were continued for determining the proportion of the water applied by irrigation which must be removed by drainage. Measurements were made in various States to ascertain the seasonal variation of the water table. An experimental underdrainage system was installed on 160 acres of the Kearney Vineyard of the California University experiment station at Fresno, Cal., in cooperation with that station, to determine the efficiency of underdrains in removing alkali. New investigations were also taken up in the Gila Valley, Ariz. Laboratory tests were undertaken to determine the strength and efficiency of lumber for box drains in the arid regions.

To meet the numerous requests for advice as to methods of reclaiming land from seepage and alkali, a report on practical methods of draining irrigated lands has been prepared for publication.

Experiments in cooperation with the Bureau of Standards, Department of Commerce, and cement-tile manufacturers were undertaken on five tracts to determine the effect of alkali on cement tile and the adaptability of cement tile for use in the arid regions, and also where the winters are long and severe.

S. H. McCrory, chief of drainage investigations, had direct charge of the work throughout the year.

NUTRITION INVESTIGATIONS.

The study was continued of problems pertaining to the relative nutritive value and use in the home of agricultural products and of ways in which information on these subjects may be made more useful to the housekeeper. The enterprise was extended and developed particularly with the object of bringing to the attention of the home

maker the large amount of work done for her benefit in the Department of Agriculture.

Experimental studies of methods of preparing corn meal and Kafir corn meal for the table were made and popular bulletins summarizing the results were published.

The studies of emergency rations undertaken at the request of the War Department were continued, with the result that an emergency ration has been devised which, so far as can be judged at the present time, will meet the special requirements, and supply the needed amount of nutritive material in a readily digestible form.

An outgrowth of this work has been the study of chocolate and its uses in the diet, an investigation which promises information regarding the use in the home of this valuable foodstuff.

The experimental study of the nutritive value, economy, culinary qualities, and use of various animal and vegetable fats undertaken in cooperation with the Bureau of Animal Industry was continued and a progress report prepared for publication.

The experimental study of the food value, culinary qualities, and uses of honey was completed and a Farmers' Bulletin prepared for publication.

Problems concerned with bread making have from time to time formed an important part of the nutrition investigations. During the past year a bulletin was prepared for publication in cooperation with the Bureau of Chemistry (and based on work carried on in that bureau) which discusses home bread-making problems and gives recipes for different sorts of bread.

The studies of the effects of cooking upon the quality of foods, of the relative value of the different methods of preparing them for the table, and of similar topics were carried out with a number of foodstuffs, and more particularly with fruits, the object being to help the housekeeper to a greater appreciation of the importance of such foods and a better knowledge of their preparation and preservation by household methods. Closely related to this is the experimental study of fruit ripening undertaken in cooperation with the Bureau of Chemistry.

Attention was also given to perfecting the microrespiration calorimeter, an instrument which promises to be very valuable in the study of many agricultural problems besides those pertaining to nutrition. Work was also carried on with the large respiration calorimeter, and plans formulated for the experimental study of the energy expenditure in the different forms of household labor and the relation of this expenditure to the different kinds of equipment and different methods of working. Closely related to this is the matter of planning and equipping a farmhouse kitchen so that the housekeeper may do her work with the minimum of labor. As a contribution to this subject a popular bulletin on "The Farm Kitchen as a Workshop" has been published and others of a similar nature prepared for publication.

As in previous years, the nutrition investigations were in charge of Dr. C. F. Langworthy.

REPORT OF THE DIRECTOR OF THE OFFICE OF PUBLIC ROADS.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF PUBLIC ROADS,
Washington, D. C., September 24, 1914.

SIR: I have the honor to submit herewith the report of the Office of Public Roads for the fiscal year ended June 30, 1914.

Respectfully,

L. W. PAGE, *Director.*

Hon. D. F. HOUSTON,
Secretary of Agriculture.

GENERAL WORK OF THE YEAR.

The total appropriation for the fiscal year was $279,400, of which $47,400 was for the statutory roll and $232,000 was for general expenses. In addition, the office is supervising the expenditure of an item of $500,000 contained in an act of Congress of August 24, 1912, making appropriation for the Post Office Department. This amount is expended in the improvement of post roads, in conjunction with States and interested localities, which provide double the amount of the Federal appropriation.

The total number of employees on June 30, 1914, was 271, as compared with 168 on June 30, 1913—an increase of 103 employees within a period of 12 months. This exceptional increase was partly due to the fact that during the year 30 traffic census takers were employed for temporary and intermittent work.

In December, 1913, P. St. J. Wilson, at that time State highway commissioner of Virginia, was made Assistant Director to fill the vacancy caused by the resignation of Paul D. Sargent, who severed his connection with the department to accept the position of chief engineer of the State highway department of Maine. A slight rearrangement of the organization was made during the year, involving the creation of two divisions of the work, designated as the Division of Maintenance and the Division of National Park and Forest Roads.

FIELD ENGINEERING.

The field engineering work, as now organized, is under the immediate direction of the Assistant Director, and comprises the following subactivities: Division of Construction, in charge of post road, object-lesson road, and experimental road construction, and bridge design and advice; Division of Maintenance, in charge of object-lesson and experimental road maintenance; and Division of National Park and Forest Roads, in charge of advice and supervision relating

to the improvement of National Park and Forest roads and trails, in cooperation with the Department of the Interior and the Forest Service.

This divisional arrangement of the field engineering work is for convenience in management, but is elastic as to personnel, as the same engineers are used interchangeably in the several divisions.

DIVISION OF CONSTRUCTION.

This division, of which Vernon M. Peirce is chief, comprises a number of projects, which are reported in detail as follows:

OBJECT-LESSON AND EXPERIMENTAL ROADS.

Object-lesson roads are constructed for the purpose of giving instruction in proper methods to local road officials. The assistance is granted upon the application of officials having jurisdiction. All materials, labor, and teams are supplied locally, while the office furnishes only the services of the engineer.

Experimental roads are constructed under authority of a special item in the appropriation for the office. This item amounted to $45,000 for the fiscal year.

Thirty-two object-lesson roads were completed, as follows: 1 cement concrete; 3 bituminous macadam; 1 bituminous surface treatment; 2 plain macadam; 9 gravel; 11 sand clay; 3 top soil; and 2 earth. These roads are located as follows: Arizona, 1; Florida, 3; Massachusetts, 1; Mississippi, 3; Missouri, 1; North Carolina, 10; South Carolina, 1; Texas, 9; and Virginia, 3. One earth road was begun in Tennessee, but was not completed, and it will be described in the annual report for 1915.

The following table shows the number of square yards of each type of object-lesson roadway constructed during the fiscal years 1905 to 1914, inclusive:

Area, in square yards, of object-lesson roads constructed during the fiscal years 1905–1914, inclusive.

Material.	1905	1906	1907	1908	1909	1910	1911	1912	1913[1]	1914[2]
Brick						526			2,055	
Concrete						1,004			3,013	782
Oil-cement concrete							1,917		1,744	
Bituminous concrete									2,898	
Bituminous-surfaced concrete									4,178	
Bituminous macadam						45,832	41,551	34,453	16,040	10,033
Surface treatment									6,386	15,911
Macadam	44,944	51,246	76,376	72,587	96,107	50,333	11,330	14,806	57,131	168,156
Asphalt-slag							578			
Oil-asphalt-gravel							900			
Oil-gravel						4,819	9,774			
Gravel-macadam									2,607	
Gravel	8,804	4,197	11,722	4,608	65,793	71,376	59,942	13,057	63,730	255,945
Slag						4,610				
Sand-clay	19,178	19,443	85,571	42,634	205,032	177,960	218,177	103,876	128,496	86,715
Sand-gumbo									5,337	
Burnt clay	400			3,392	2,041					
Shell	5,877	933		14,020	1,630				43,717	
Earth		12,132	27,042	85,967	319,456	651,109	140,933	556,663	162,696	127,495
Top soil										26,498
Total	79,203	87,951	200,711	223,208	690,059	1,007,569	485,102	722,855	500,028	691,535

[1] Includes experimental roads.
[2] Includes experimental and post roads and county work in Vermont.

One experimental road was constructed in Maryland in which the work consisted of a surface treatment of a water-bound macadam road with various bituminous materials.

The total cost of the work, including the experimental road, but exclusive of the salaries and expenses of the engineers furnished by this office, was $108,115.36.

The area of post roads, object-lesson, and experimental roads aggregated 691,535 square yards, an increase of 191,500 square yards, or about 38½ per cent over the total for 1913.

BRIDGE WORK.

The bridge work was in charge of Charles H. Moorefield until May 1, 1914, at which time Mr. Moorefield was placed in charge of important concrete road construction in Ohio, involving an expenditure of $320,000. Oscar L. Grover, who succeeded Mr. Moorefield, was formerly the chief bridge engineer of the Chesapeake & Ohio Railroad, and of the Virginia State highway department.

Typical designs were prepared for I-beam bridges with wooden floors for spans from 12 feet to 40 feet, varying in length by 2 feet. Copies of typical plans have been furnished wherever suitable for a particular location to the extent of about 1,100 blue prints. Special designs, prepared for locations where typical designs could not be used, were made and distributed as follows: Alabama, 2; Arizona, 1; Mississippi, 5; North Carolina, 12; South Carolina, 6; Tennessee, 1; Virginia, 1. In a few cases designs prepared by bridge companies have been checked and reviewed for the benefit of local officials.

Fifteen inspections were made during the fiscal year 1914, in connection with which the local officials were advised as to the kinds of bridges and culverts best suited for their use in each location.

COUNTY ROAD SYSTEM.

Systems of roads were devised for 17 counties, namely: Sussex County, Delaware; Allen County, Indiana; Jackson County, Indiana; Calcasieu Parish, Louisiana; Tangipahoa Parish, Louisiana; Coahoma County, Mississippi; Collin County, Texas; Falls County, Texas; Freestone County, Texas; Reeves County, Texas; Rusk County, Texas; Scurry County, Texas; Shelby County, Texas; Salt Lake County, Utah; Fayette County, West Virginia; Kanawha County, West Virginia; and Mercer County, West Virginia.

SUPERINTENDENCE OF COUNTY ROADS.

Bennington County, Vermont.—A superintendent of road construction and an assistant were assigned to Bennington County, Vermont, from April 12, 1913, to December 13, 1913. The entire system of 750 miles of roads was inspected at various intervals. Recommendations for improvements in methods of road administration and construction were made to State, county, and township authorities; and the office representative was in direct charge of practically all road improvement carried on in the county. The construction consisted principally of the reduction of grades, the

elimination of dangerous curves, and surfacing with various local materials, with special attention to improvements in the methods of road drainage. The entire cost of the work, exclusive of the salaries and expenses of office representatives, was $48,981.72. The areas of the various types of road constructed are tabulated elsewhere with object-lesson roads. The officials of Bennington County were so pleased with the results of this object-lesson supervision that they have since employed an engineer to take charge of the road work of the county.

Rutland County, Vermont.—From April 21 to December 15, 1913, a superintendent of road construction and an assistant were stationed in Rutland County, Vermont. The work was similar to that conducted in Bennington County. Sixty sections of road of a total length of 14.87 miles were constructed, and the maintenance of 478 miles of selected road was supervised. The total expenditure for new construction, bridge and culvert work, and resurfacing amounted to $63,185.32; and the areas of the various types of construction are tabulated with object-lesson roads.

Fairfax County, Va.—On May 1, 1914, a senior highway engineer was assigned to supervise the construction of roads in Mount Vernon district of Fairfax County, Va., involving the expenditure of about $116,000. This work was in progress at the end of the fiscal year and will be reported in detail in the annual report for 1915.

SPECIAL INSPECTION AND ADVICE.

Engineers were assigned to make inspections of roads and advise with local officials in 25 States, as follows: Arizona, 3; Arkansas, 2; Florida, 4; Georgia, 7; Idaho, 1; Indiana, 1; Kansas, 5; Kentucky, 4; Louisiana, 2; Maryland, 1; Massachusetts, 2; Mississippi, 7; Missouri, 1; Nebraska, 5; New Hampshire, 1; New Jersey, 1; New York, 1; North Carolina, 14; Oklahoma, 4; Rhode Island, 1; South Carolina, 2; Tennessee, 8; Texas, 11; Virginia, 11; and West Virginia, 5—a total of 104 assignments.

POST-ROAD CONSTRUCTION.

The Post Office appropriation act of August 24, 1912, appropriated $500,000 for improving, under the supervision of the Secretary of Agriculture, such roads as may be selected by the Postmaster General and the Secretary of Agriculture. Up to the close of the fiscal year 463.5 miles of road had been definitely selected for improvement, plans and specifications had been made, and most of this mileage was under construction. The work comprises 17 projects, located as follows: Alabama, Lauderdale County; Iowa, Boone and Story Counties, and Dubuque County; Kentucky, Bath and Montgomery Counties; Maine, Cumberland County; Maryland, Montgomery County; Mississippi, Leflore County; North Carolina, McDowell County, and Forsyth, Davie, and Iredell Counties; Ohio, Licking and Muskingum Counties; Oregon, Jackson County; South Carolina, Aiken County; Tennessee, Montgomery County and Loudon County; Texas, Bexar, Guadalupe, Hays, Comal, and Travis Counties; Virginia, Fairfax County, and Spotsylvania, Hanover and Caroline Counties.

Only one project, that in Lauderdale County, Ala., was completed during the fiscal year. The work on this project consisted of grading 72,240 square yards of road at a cost of $25,781.09, and surfacing a part of the road at a cost of $2,166.05, making the total cost $27,947.14, exclusive of the salaries and expenses of the office representatives.

INSTRUCTION IN HIGHWAY ENGINEERING.

In continuance of the previous policy of the office, nine young men were appointed to the position of civil engineer student during the year, but two of them have since resigned.

Appointments to this position are made from an eligible list established through examination by the Civil Service Commission. The examination is open only to graduates of the engineering institutions of the country; and it is intended that the position shall provide, for a limited number of such graduates, an opportunity for a graduate course in highway engineering, while the appointees at the same time render actual service to the Government. A description of the course of instruction may be found in previous annual reports.

ROAD SURVEYS.

Engineers have been detailed to make surveys of roads in five States, as follows: Arizona, 1; Arkansas, 2; Indiana, 1; Mississippi, 1; and South Carolina, 1.

ROAD MAINTENANCE.

On account of the great increase of bond issues for road construction since 1910 and the general failure of local officials to make provision for maintenance, there has been a corresponding increase in the demands upon this office for advice and assistance in preserving the roads from destruction. To meet this heavy demand, a Division of Road Maintenance was created under date of February 16, 1914, and E. W. James was made chief of it. Specific lines of work were approved as follows:

1. A study of the details of State road maintenance in representative States.
2. A study of the details of county road maintenance in selected counties.
3. Supervision of maintenance on post roads when completed.
4. Supervision of maintenance on connecting roads from Washington to Atlanta.
5. Experimental maintenance of selected roads in Alexandria County, Va., and Montgomery County, Md., and on the grounds of the Department of Agriculture.
6. Introduction of adequate maintenance on a selected road in each of a limited number of counties which issued bonds for road construction during 1912 and 1913.

In carrying out these lines of work, arrangements were completed to begin early in July a proposed study in the States of Massachusetts, New Hampshire, Connecticut, and New York. The work under way in Alexandria County was continued with one patrolman, and contract with the county renewed for the next fiscal year. In Montgomery County maintenance has been continued on the Rockville Pike, Bradley Lane, and Kensington Road by two patrolmen.

On the grounds of the Department of Agriculture all of the drives under observation have been resurfaced.

WASHINGTON-ATLANTA HIGHWAY.

For the purpose of conducting an object lesson in road maintenance on a sufficient scale to attract general attention, and at the same time render the largest amount of assistance at the least relative cost to the Office of Public Roads, a project involving the supervision of maintenance on a continuous series of roads extending from Washington to Atlanta was undertaken. This project has absorbed a large part of the energies of the Division of Maintenance since its organization, and has been accompanied by an unexpected degree of success. The plan as finally adopted involved the payment by the counties of the expense of maintenance, excepting supervision, which was to be provided by the office.

It was found that most of the road between Washington and Richmond was in process of construction, and, therefore, not ready for maintenance. A number of other sections of road were found to require construction work before maintenance could be undertaken.

Up to June 30, 1914, applications for supervision under this plan had been received from 28 of the 49 counties traversed by the road system, the total length of which was 1,037.8 miles. Of this length, 641.3 miles have been placed under the direction of the office and funds for maintenance have been pledged to the amount of $30,985, which covers the expenses of maintenance for the period of one year. In addition to this amount, an aggregate of $102,740 has been provided for construction in anticipation of maintenance.

The work has been divided into three divisions, each in charge of an engineer from this office.

The project has aroused such general interest that representatives of civic organizations in Augusta, Savannah, Jacksonville, and elsewhere have approached the office with proposals to extend the work to those cities.

NATIONAL PARK AND FOREST ROADS.

The Division of National Park and Forest Roads, of which T. Warren Allen was made chief, was created on February 16, 1914, to take charge of certain road work to be done in some of the National Parks, in cooperation with the Department of the Interior, and of road work to be done in some of the National Forests, in cooperation with the Forest Service of the Department of Agriculture.

During the fiscal year since the creation of the division very little road construction was done, since the work was confined to the preparation of plans for future work.

An engineer was placed in Yosemite National Park and one in each of Forest Service Districts Nos. 2, 3, 4, 5, and 6. Plans were also made for placing an engineer in Glacier National Park and a survey party in General Grant and Sequoia National Parks, and for making an inspection of road conditions and necessities in Rainier National Park, Wind Cave National Park, and the Arkansas Hot Springs Reservation.

In Yosemite National Park a topographic survey was begun on the floor of the valley for use in establishing a new village site. At the

end of the fiscal year this survey was nearly completed. A survey was also begun for use in designing a modern highway extending into the park from the park entrance, about 1 mile west of El Portal. At the end of the fiscal year about 5 miles of this survey had been completed.

Reconnaissance surveys were made in the park in order to gain such information as would permit laying out a proper system of roads and trails. Similar surveys were also made in Sequoia National Park and Glacier National Park.

In the Forest Service districts the various road projects which seemed worthy of immediate consideration were tabulated, and of the more important ones a field inspection, or reconnaissance, was made in order that lists of the projects might be drawn up, giving each project such place on the lists as its importance indicates.

Congress has provided that 10 per cent of the receipts of the Forest Service shall be expended in constructing roads and trails within the National Forests. As indicating the scope of this work, it may be stated that the money available for use amounted to $210,925 for the fiscal year 1912, and $239,192 for the fiscal year 1913.

During the calendar year 1914 road-survey work is continuing in Yosemite National Park to provide information for drawing up plans and estimates for a complete road system for the park. Similar work will be begun or continued in Glacier National Park, Montana, Sequoia National Park, California, and General Grant National Park, California. An inspection and report, with recommendations, will be made on road conditions in Rainier National Park, Washington, Wind Cave National Park, South Dakota, and the Hot Springs Reservation in Arkansas.

In the National Forest work the preparation of lists of projects, giving the order in which roads should be constructed, will be completed and forwarded to the Forester for his approval.

ECONOMIC AND STATISTICAL WORK.

This branch of the work is organized as the Division of Economics, of which J. E. Pennybacker is chief. Mr. Pennybacker took charge of the work on March 15, 1914, succeeding Dr. L. I. Hewes, who was transferred to field work.

GENERAL STATISTICAL AND RESEARCH INVESTIGATIONS.

The collection of data relating to bond issues was completed, and a comprehensive bulletin dealing with every phase of the subject was prepared and is now in the course of publication. Reports were obtained from State collaborators each month during the year, showing progress of road construction and maintenance, including appropriations, costs, mileage, types, and dimensions. The information thus obtained was compiled in the form of a statistical table and issued to the public. Preparations were begun, through correspondence, for a census of road mileage, revenues, and expenditures throughout the United States, to be actively inaugurated at the close of the calendar year 1914, in accordance with the previous practice of making such a census at five-year intervals. A State index is kept, on which an accurate and complete record of the progress in road improvement in the various States is shown.

COUNTY ECONOMIC STUDIES.

The investigations begun in 1910, for the purpose of determining as accurately as possible the economic results of road improvement on the prosperity and development of counties, were completed in the spring of 1914. During this interval, successive annual studies were made in Spotsylvania, Dinwiddie, Wise, and Lee Counties, Virginia; Dallas County, Alabama; Lauderdale County, Mississippi; Manatee County, Florida; and Franklin County, New York, in each of which the road improvement was made by means of bond issues. The results of these investigations are now being prepared for publication.

STUDIES OF MANAGEMENT, CONSTRUCTION, AND MAINTENANCE.

In April, 1914, an investigation designed to include 100 or more counties throughout the United States was begun for the purpose of obtaining a comprehensive insight into the methods of management, construction, and maintenance of roads under local control. It is expected that as a result of this investigation a series of instructive publications will be issued, indicating the lines along which the best results may be obtained by counties in the management of their roads. At the close of the year, studies had been completed in six counties and were progressing in others.

STATE HIGHWAY SYSTEMS.

Plans were made for an expert study, to be begun early in the fiscal year 1915, covering the organization, methods of operation, and results accomplished by the various State highway departments. The results of this investigation will be published in 1915.

ECONOMIC STUDY OF POST ROADS.

On each of the post roads heretofore mentioned thorough economic studies were conducted in order to obtain the information called for in the act of August 24, 1912, making appropriations for the Post Office Department. The studies comprise the determination of traffic areas served by each road, the tonnage and average haul in such areas, the cost of hauling, the financial outlay, the benefits and burdens brought about by the improvement, and the possible saving to the Government in lowering cost or increasing efficiency of rural delivery and parcel post. This work is continuing.

TRAFFIC CENSUS.

On each of the post roads in Montgomery County, Maryland, and on the experimental roads located in that county, an exact count of traffic is made at suitable intervals. On the experimental roads the traffic census is taken for a 24-hour period every thirtieth day. On the post roads the traffic census has been taken for a period of one week at three-month intervals, but the plan has been modified so as to cover a two weeks' census at the crop-moving periods. The data thus obtained, taken in connection with the construction and maintenance data, should prove exceedingly useful in showing the effect of

various kinds and volumes of traffic upon the several types of construction and under the different systems of maintenance in effect, and should also indicate the relative traffic importance of the roads improved.

LECTURES, ADDRESSES, AND PAPERS.

During the year 331 lectures and addresses were delivered in 46 of the States by 35 of the representatives of the office, as compared with 558 lectures in 1913. The total attendance was 78,826, as compared with 95,948 for 1913. These lectures were given mostly at farmers' meetings and road conventions. Several papers were read at colleges and universities, and several before scientific organizations and societies.

The office does not send lecturers to any community except upon request, and not then until assured that the meeting has been properly advertised and that the attendance will justify the expense. During the year a large number of applications for lectures were refused, and this accounts for the decrease in number of assignments of this character.

MODELS AND EXHIBITS.

Exhibits consisting of models and enlarged photographs illustrating the best methods of road, bridge, and culvert construction, road drainage, maintenance, and repair, and road-building machinery and equipment have been made during the year at various expositions, congresses, and fairs.

Exhibits furnished by the office were made during the year at the following places and under the auspices of the organizations named: Arkansas State Fair, Hot Springs; Kankakee County Farmers' Institute, Kankakee, Illinois; United States Land Show, Chicago, Illinois; State Fair, Des Moines, Iowa; Association of County Commissioners, Council Bluffs, Iowa; State Fair, Louisville, Kentucky; State Road Convention, Bangor, Maine; American Road Congress and Exposition, Detroit, Michigan; State Fair, Columbus, Ohio; Dry Land Congress and Exposition, Tulsa, Oklahoma; State Fair, Oklahoma City, Oklahoma; National Conservation Exposition, Knoxville, Tennessee; National Corn Exposition, Dallas, Texas; Texas Good Roads Convention, Fort Worth; American Road Builders' Convention, Philadelphia, Pennsylvania; and Case School of Applied Science, Cleveland, Ohio.

The total estimated attendance of persons who examined the exhibits of the office at these various expositions was 300,000. The cost of installation, drayage, freight, and repacking was paid by the exposition companies interested, except in the case of the exhibit sent to Tulsa, Oklahoma, where all expenses were paid out of a special fund appropriated by Congress.

PUBLICATIONS AND LIBRARY.

Five publications were issued during the year, comprising Department Bulletins 23, "Vitrified Brick as a Paving Material for Country Roads"; 53, "Object-Lesson and Experimental Road and Bridge Construction of the U. S. Office of Public Roads, 1912–1913"; and 105, "Progress Reports of Experiments in Dust Prevention and Road

Preservation, 1913"; Farmers' Bulletin 597, "The Road Drag and How to Use It"; and the "Report of the Director of the Office of Public Roads" for the fiscal year ended June 30, 1913. Two other publications were prepared during the year and will be issued within the near future. These are "Portland Cement Concrete Pavements for Country Roads" and "Highway Bonds."

The library of this office now contains approximately 9,000 volumes. The collection of State documents on the subject of roads is practically complete for this country and for such foreign countries as issue highway publications.

Eighty-six periodicals are received, of which 32 are contributed by the department library and 54 are received directly from the publishers without cost to the office.

The mailing lists of the office are in the charge of the library, and during the year the five publications which were issued were sent to a total of 25,000 persons whose names are on the mailing lists of the Office of Public Roads and to approximately 47,000 other persons whose names are on the department mailing lists or who have applied from time to time for recent information from this office.

PHOTOGRAPHIC AND MODEL WORK.

In the photographic laboratory 1,855 negatives, 8,783 prints, 1,698 lantern slides, 610 bromide enlargements, and 3,703 blue prints were prepared. The office now has on file 11,146 negatives. During the year 2,390 lantern slides were colored. The lantern slide collection of the office numbers 7,175 slides, of which about two-thirds are colored.

On July 16, 1913, the preparation of models was much facilitated by the transfer of Mr. H. W. Hendley from the Smithsonian Institution to this office as model maker. During the year, 70 models illustrating various types of road construction were restored and 30 new road models, 3 culvert models, 1 drainage model, 1 bridge model, 1 model showing various construction features in the Alps, and 1 large relief model of the Yosemite Valley of the Yosemite National Park were constructed.

INVESTIGATION OF ROAD MATERIALS.

A total of 932 samples of road-building material was tested in the physical and chemical laboratories during the fiscal year 1914. This is an increase of 12 per cent over the number of samples tested during the preceding year.

PHYSICAL TESTS.

The work in the physical laboratory was carried on under the supervision of E. B. McCormick, the mechanical engineer of the office. The samples sent in for test and on which reports were made consisted of the following materials: Gravels, 141; limestones, 105; dolomites, 55; granites, 37; sandstones, 33; traps (various), 51; clays, 22; gneiss, 10; marble, 12; quartzite, 12; sand, 19; schist, 12; miscellaneous,[1] 96; making a total of 605 samples.

[1]Among those listed under miscellaneous were brick, cement, chert, soil, mineral ores, waterproofing materials, etc.

The States from which the greatest number of samples were submitted were: Virginia, 77; Pennsylvania, 60; Illinois, 38; Maine, 23; Texas, 23; Vermont, 22; New York, 21.

In addition to the routine work, as noted above, research investigation was continued relative to the road-building properties of various materials. Necessary apparatus was added and experiments were started to determine the effect of freezing on the properties of road-building materials. The scope of the investigation of the properties of plain and reinforced concrete and of oil-cement concrete has been materially increased during the past year. The work done in previous years in determining the distribution of stress throughout reinforced concrete slabs has been continued, and special apparatus has been designed in the office and erected on the grounds of the Arlington farm for testing full-sized concrete bridges. The apparatus is so designed that the behavior of the concrete may be studied under different conditions of loading. The load may be varied in its nature from that of a concentrated load applied at the center to that of a load uniformly distributed over the entire surface of the slab. Within this range of loading it is possible to obtain conditions identical with those existing when a road roller or traction engine is passing over the bridge.

In addition to studying the contraction and expansion of concrete specimens in the laboratory, observations and measurements have been taken on concrete roads at Chevy Chase, Md., and at Zanesville, Ohio. Much work has been done in standardizing the methods to be employed in testing gravel to determine its value for road-building purposes.

The work of giving instruction in the testing of road materials has been carried on as during past years, and not only have student engineers and senior highway engineers connected with the office received instruction in the laboratory, but, in addition, instructors from various State universities and agricultural colleges have taken the course.

CHEMICAL INVESTIGATIONS.

During the fiscal year 327 samples were received by the chemical laboratory for examination, which is the largest number in any year since the inauguration of this line of work. In addition to the usual number of bituminous road materials, principally asphalt, tar, and petroleum products, numerous samples of sand were examined with a view to determining their fitness for bituminous sand construction, and some definite recommendations were made which it is believed will result in the economic betterment of road conditions in sections which have hitherto been considered as possessing no available material. A number of samples of native bituminous sandstone were also examined and recommendations made for their utilization. In addition, the petrographic laboratory examined and classified 541 samples of rocks for road building, making a grand total of 868 samples which passed through the chemical laboratory, or an increase of nearly 24 per cent over the work of the preceding year. There was also an increase in the distribution of circulars giving specifications for bituminous materials and explaining methods of application; 134 copies were distributed in 27 States and Territories.

This large increase in routine work curtailed to some extent the preparation of new material for publication, but continued work has been done on the effect of exposure of bitumens, besides some new and valuable research upon the comparative binding value of various rocks in conjunction with bituminous binders. A revised melting-point method and a new method for the determination of paraffin scale have also been investigated at length. The laboratory is now actively represented on three sections of the Committee on Standard Tests for Road Materials of the American Society for Testing Materials.

In the field of instruction there has been greater activity than in any previous year. Twelve highway engineers, 7 civil engineer students, and 2 representatives of State universities took courses in the chemical and petrographic laboratories.

In cooperation with the engineering divisions, further experiments in the utilization of coralline rock with bituminous binders were inaugurated at West Palm Beach, Fla., and the success of these and others previously carried out at Miami has led to recommendations for similar construction on a large scale. The construction and the bituminous treatment of shell roads have also been successfully developed.

FIELD EXPERIMENTS.

Traction tests have been conducted in various localities under the supervision of E. B. McCormick, mechanical engineer. These tests were primarily for determining the effect of the width of tire on draft and on road surfaces, and the effect of the nature of the road surface, the condition of the road surface, the grade, the diameter of the wheel, and the method of hitching on the draft required to haul vehicles.

Traction tests have in general been made in connection with other activities of the office, particularly in connection with the building of post roads. The particular object sought in these cases was to determine the actual effect of road improvement on draft. In order to secure fair averages, these tests have been conducted over stretches of roadway varying from 5 miles to 75 miles in length and were located in the States of Minnesota, Iowa, Alabama, Mississippi, Ohio, Maryland, Virginia, and Maine.

During the fiscal year 1914 designs were prepared for the construction of a dynamometer car, by the use of which the number and mileage of tests may be increased and information secured regarding the effect of different types and conditions of road surfaces on the draft of motor-driven vehicles.

REPORT OF THE SOLICITOR.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SOLICITOR,
Washington, D. C., October 1, 1914.

SIR: I submit herewith the report of the work of the Office of the Solicitor for the fiscal year ended June 30, 1914.

Respectfully,

FRANCIS G. CAFFEY, *Solicitor.*

HON. D. F. HOUSTON,
Secretary of Agriculture.

SUMMARY.

There was a marked increase in the volume of work done by this office during the fiscal year 1914. This was due chiefly to (1) more frequent advice to administrative officers upon legal questions arising in the conduct of the department's business, (2) preparation of reports to the Attorney General of a larger total of violations of the statutes administered by the department, and (3) an unusual amount of consideration given to bills pending in Congress.

One thousand and seven written opinions, including 594 for the Forest Service, were rendered to the Secretary, chiefs of bureaus, United States attorneys, and employees of, or persons affected by the work of, the department, on law questions. Numerous informal opinions, of the number of which no account was kept, were also rendered.

Aid was given to administrative officers in revising and preparing proposed amendments to regulations, including those relating to meat inspection, National Forests, food and drugs, migratory birds, animal quarantines, and plant quarantines.

Special attention was given to revision of the meat inspection regulations. During November, 1913, representatives of this office and of the Bureau of Animal Industry together visited slaughtering and packing establishments for the purpose of obtaining first-hand knowedge of the operation of the regulations then in force, which were adopted in 1908. In January, 1914, they also investigated the handling of imported meats at the port of New York. Each provision of the old regulations was critically considered with the view of making the system of inspection more complete and effective. The revised regulations, dealing with both domestic and imported meats, have been issued in pamphlet form, comprising 97

printed pages. They will become effective with respect to domestic meats on November 1, 1914, and with respect to imported meats on January 1, 1915.

Many documents of various kinds, including statements of issues, briefs, and memoranda on legal matters, were prepared on behalf of the officers of this department for submission to the Attorney General, the Secretary of the Interior, the Comptroller of the Treasury, and officers of other departments. Among the questions involved were whether the Secretary of the Treasury, the Secretary of Agriculture, and the Secretary of Commerce are empowered by the so-called net weight amendment (37 Stat., 732), in connection with section 3 of the food and drugs act, to establish reasonable variations; whether the eight-hour law applies to laborers employed in the cooperative improvement of rural delivery routes; whether employees classified as laborers paid out of lump sum appropriations may be promoted; whether claims to lands which have been finally canceled may be reinstated, notwithstanding the fact that the lands are embraced within the National Forests; whether an entry which is invalid at the date of withdrawal of lands for forest purposes, because of the claimant's failure to comply with the law, may be revived by subsequent visits to the land; and what acts are necessary to meet the statutory requirement of continuous residence for five years prior to the issue of patent for public lands.

Law work performed by the office for the Forest Service during the year included handling the following cases and other business:

Claims to lands	905	Trespasses:		Written opinions	594
Hearings attended	149	Grazing	153	Contracts	1,495
Depositions taken	81	Timber	91	Proclamations	13
Briefs prepared and filed	219	Fire	80		
Oral arguments	7	Occupancy	26		
		General litigation	43		

A conference was held at Salt Lake City on November 10, 11, and 12, 1913, between the Solicitor and his assistants in charge of the legal work of the Forest Service in the six National Forest districts in the West. The objects were to devise means for more economical and effective handling of the business and to enable the Solicitor to obtain the views of all the assistants at a time when general discussion among them would aid in reaching definite conclusions. The conference covered a wide range and resulted in the adoption of several reforms in methods.

The following summary shows the work of this office during the year in connection with the acquisition of lands under the Weeks forestry law:

Character of work.	Tracts.	Acreage.
Agreements of purchase prepared	261	[1] 288,372
Titles in process of examination at the beginning of the year	17	[1] 90,000
Examinations of titles completed and reported to the Attorney General	105	[1] 132,944
Examinations of titles completed, but not reported to the Attorney General	83	[1] 88,545
Titles in process of examination at the end of the year	102	[1] 112,165
Condemnation proceedings recommended	44	36,632.05
Condemnation proceedings prepared or in which assistance was rendered to United States attorneys	27	[1] 136,713
Completion of direct purchases after approval of titles by the Attorney General	22	7,303.08
Completion of purchases of lands acquired through condemnation	10	82,246.87

[1] Approximate.

Eight meetings of the National Forest Reservation Commission were attended.

A conference was held at Asheville May 18 to 21, 1914, between the Solicitor and the record examiners. Among the subjects discussed were forms of agreements of purchase, vendors' abstracts, methods of examining titles, tax titles, condemnation proceedings, adverse possession, cooperation with the Forest Service and the Department of Justice, duty of record examiners to vendors, forms of reports of record examiners, State grants, and locating parties to condemnation proceedings. Copies of the minutes of the meeting will be furnished to record examiners and other officers of the Government engaged in work incident to the acquisition of lands under the Weeks law.

In addition to purchase agreements under the Weeks law and contracts prepared for the Forest Service, 250 contracts and leases and 12 bonds for temporary disbursing agents were drafted for the several bureaus, offices, and divisions of the department.

Violations of statutes intrusted to the department for enforcement upon which reports were made, and prosecutions recommended, to the Attorney General, and the amounts of fines and recoveries in cases terminated and reported to this office, during the year were as follows:

Law invoked.	Violations.	Fines and recoveries.	Law invoked.	Violations.	Fines and recoveries.
Laws for the protection of National Forests	261	[1] $32,711.56	Insecticide act	97	$2,155.50
Food and drugs act	487	10,406.00	Plant quarantine act	15	
Twenty-eight hour law	1,545	43,375.00	Virus act	2	
Animal quarantine acts	254	9,980.00	Protection of bird reserves	1	30.00
Meat inspection law	154	3,097.50	Miscellaneous	6	400.00
Lacey Act	180	5,550.75	Total	3,016	107,846.31
Migratory bird law	14	140.00			

[1] $6,035.93 outstanding.

In addition, 333 decrees of condemnation and forfeiture were entered under the food and drugs act, and 4, under the insecticide act.

There was a decrease of reported violations of laws for the protection of the National Forests. It is believed that this was a natural consequence of more general compliance with the regulations of the Secretary of Agriculture governing the use and occupancy of the Forests, the validity of which was questioned in previous years, but was affirmed by the Supreme Court in the Grimaud and Light cases (220 U. S., 506, 523).

Fewer violations of the food and drugs act were reported in 1914 than in 1913. It is believed that this was due primarily to (1) more accurate understanding by manufacturers and dealers of the requirements of the law, coupled with intent by many voluntarily to conform to its provisions, (2) abandonment of forms of adulteration and misbranding against which prosecutions have been successfully maintained, and (3) procuring, through correspondence, without prosecution, correction of minor, unintentional, infractions of the law not involving foods that were filthy, decomposed, or putrid, or those containing added poisonous or deleterious ingredients which might render them injurious to health. Furthermore, during the early part

of the fiscal year 1914 the Bureau of Chemistry devised and put into effect a plan for collecting and examining samples of drugs with a view to prosecution on the charge of misbranding under the Sherley Amendment (37 Stat., 416). The completion of analyses of such samples requires much time. A great many cases involving these articles were under consideration by this office at the close of the year.

Reasons similar to those above ascribed for the reduction of cases under the food and drugs act have kept lower than it otherwise would have been the amount of litigation under the insecticide act and some of the other regulatory acts with which this department is concerned.

This office examined all the evidence gathered by department inspectors, and communicated to it, and advised that prosecutions could not be maintained, in a considerable number of cases.

Reports coming to the office from various sources which disclosed apparent violations of the postal laws and regulations were referred to the Postmaster General for investigation.

Many memoranda on legal questions involved in cases reported to the Department of Justice for prosecution were furnished by this office. Among those in which it assisted in the preparation of briefs were United States *v.* Lexington Mill and Elevator Co. (232 U. S., 399); United States *v.* 40 Barrels and 20 Kegs Coca-Cola (Circ. 80, Office of the Solicitor); and St. Louis Independent Packing Co. *v.* Houston (204 Fed., 120; 215 Fed., 553).

During the year, with the approval of the Attorney General, instead of sending letters, reciting the facts, as was formerly done, the practice was adopted of reporting cases to him in the form of proposed informations, already completely drafted, for use by the United States attorneys in prosecutions under the food and drugs act, animal quarantine acts, and insecticide act. Requests of the United States attorneys for assistance in the preparation and conduct of trials of cases, especially those which were particularly technical or important, were complied with.

This office reviewed 59 cases involving questions of irregularity or misconduct by employees in the performance of their official duties. In each the facts were investigated. In 27, formal charges were prepared, and, after the employees concerned had had full opportunity to reply, the charges, the answers, and the evidence received consideration, and the matters were reported to the Secretary for his decision.

Two applications for letters patent on inventions of employees of the department for dedication to the public were prepared and filed.

Twenty-five claims for balances due estates of employees of the department who died intestate were examined, the necessary papers prepared for their payment, and advice furnished administrative officers of the department relative to the same.

At the instance of committees of Congress, or upon instructions of the Secretary, aid was given in drafting, or in drawing the department's reports on, bills dealing, among other subjects, with cotton futures, cotton standards, grain futures, grain standards, cotton warehouses, grain warehouses, construction and maintenance of roads, water power, various matters affecting National Forest lands, and the

establishment of a national arboretum. Memoranda on amendments to the food and drugs act and the meat inspection law and on the farm land banks bill, with discussions of the law points involved, were also prepared.

Notwithstanding the large volume of business, there was no increase in the force of law clerks. In consequence of its growth, the work of the office fell somewhat in arrears. It is believed that this condition can soon be remedied, so far as concerns matters of types heretofore dealt with, by the addition of one law clerk authorized by the appropriation act for 1915. But the new types, resulting from the enactment of the cotton futures law and of other statutes intrusted to this department for administration, and the extension of the activities of the department, especially those relating to marketing and rural organization, if kept current, will almost certainly necessitate employing more law clerks.

Tabulated statements showing, in detail, facts and status of the principal prosecutions originating in the department, in which United States attorneys have commenced proceedings, and of the claims and other cases affecting the administration of the National Forests in which this office is concerned, are submitted herewith for your information. It is recommended that these be filed in the office of the Secretary for reference.

Somewhat detailed statements of the principal activities of this office, without reiteration of what has been fairly covered by the foregoing summary, follow.

ADMINISTRATION OF ACTS OF CONGRESS.

STATUTES RELATING TO THE NATIONAL FORESTS.

LAND CLAIMS.

Nine hundred and five cases, involving claims to upwards of 150,000 acres of lands in National Forests, under the homestead, timber and stone, mineral, lieu and railroad selection, and other general and special land laws of the United States, were handled. Three hundred and five cases were closed, 263 after final adjudication by the Secretary of the Interior or the Commissioner of the General Land Office, 19 by relinquishments filed by the claimants, 3 by elimination of the land from the National Forests, 15 by notice that the Forest Service had no objection to offer to issuance of patent or allowing the entry to remain intact, 3 by withdrawal of charges against the claims, and 2 by claimants' withdrawal of applications to enter the lands. Of the 263 finally adjudicated by the Secretary or the commissioner, 155 resulted favorably, and 108 adversely, to the United States. The decisions in favor of the Government resulted in the retention in the National Forests of upwards of 27,000 acres of land supporting approximately 155,000,000 feet of merchantable timber, worth about $250,000. Of 90 decided by the registers and receivers, subject to review by the commissioner and still pending at the close of the year, 46 resulted favorably, and 44 unfavorably, to the United States. The remaining 510 cases received attention in this office varying in degree with their progress in the Forest Service and in the Interior Department.

Assistants to the Solicitor in the field examined and passed upon the evidence in many cases preparatory to reports to the Commissioner of the General Land Office recommending adverse proceedings against claims. They also were in frequent conferences with executive officers of the Forest Service in the field on questions arising out of claims cases.

Duplication in the work of the Department of the Interior and of this department in the handling of litigation growing out of claims to lands has been so reduced that it is not believed to be of enough importance to demand further consideration.

DECISIONS OF THE SECRETARY OF THE INTERIOR.—Three decisions of the Secretary of the Interior of far-reaching effect, rendered during the year, deserve special mention. Two of them were adverse, and one favorable, to the Government.

Ex parte J. P. Nichols and Cy Smith expressly overruled the decision of the Department of the Interior in H. H. Yard et al. (38 L. D., 59), rendered in 1909. In the Yard case, the department held, after elaborate consideration, that it had full authority, of its own motion or at the instance of others, in advance of application for patent, to inquire into mining locations within National Forests and determine whether the same were preceded by the requisite discovery of mineral and whether the lands were of the character subject to occupation and purchase under the mining laws, and, if the locations were found to be invalid, to administer the lands upon which they were made as part of the public domain, irrespective of the locations. In the Nichols and Smith decision, the Department of the Interior denied its power to entertain proceedings against a mining claim where the claimant had not applied for patent, and held that, prior to application for patent, the Government must apply to the courts for relief against unwarranted locations of mineral claims on public lands and in National Forests. The Solicitor filed a motion for a rehearing of this case, and supplemented his brief by oral argument. Decision upon this motion had not been rendered at the close of the year.

Ex parte Jacob A. Harris expressly overruled Mertie C. Traganza (40 L. D., 300), decided in 1911. In the latter case, the Department of the Interior held that the proviso in section 7 of the act of March 3, 1891 (26 Stat., 1095), has no reference to proceedings by the United States in respect to entries of the classes therein specified, and does not affect the conduct or action of the Land Department in taking up and disposing of final proof of entrymen after the lapse of the two years mentioned in the act. In the Harris case, the view was announced that this provision applies to the United States and that no proceedings can be prosecuted against a claim of the character mentioned unless the proceedings were directed by the Commissioner of the General Land Office within two years after the issuance of final certificate. Motions for review and for the exercise of supervisory authority, with briefs in support thereof, were filed by the Solicitor. The Department of the Interior denied the petition for exercise of supervisory authority and thus finally reaffirmed its former decision.

In ex parte Henry A. Benham, the Department of the Interior, on August 21, 1913, entertained claimant's application for reinstatement

of his entry for 160 acres of valuable timbered land in the State of Washington. The entry had been canceled by the Secretary of the Interior on March 10, 1913, after claimant's successive appeal from the Commissioner of the General Land Office, motion for review, and petition for the exercise of supervisory authority, and the cancellation had been perfected by notation thereof on the tract books in the local land office. The Solicitor filed a motion for review and applied for an oral argument, and oral argument was presented to the Secretary of the Interior. Decision upon the motion had not been rendered at the close of the year, but on March 4, 1914, the Secretary issued a formal order that "whenever, after due procedure, under the law and rulings of this department, any entry within an existing forest reserve has been canceled by order of this department, it will hereafter be held that such matter is closed, and is not subject to subsequent motion or order before or by the department." This order grew out of the argument in the Benham case and under it a number of like applications for reinstatement of canceled entries have been denied.

TRESPASS.

Damages and fines recovered during the year for trespasses upon the National Forests were:

Class of trespass.	Damages.	Fines.
Grazing	$6,520.97	$310.00
Timber	16,343.47	80.00
Fire	6,749.40	1,210.00
General	1,397.72	100.00
Total	31,011.56	1,700.00

In addition, 26 cases of illegal occupancy of National Forest lands, principally involving the appropriation of lands for hydroelectric power development and transmission without permit or illegal inclosures, were dealt with by the institution of injunction proceedings, settlement without recourse to the courts, or other means not including the assessment of damages or fines. Jail sentences were imposed in several cases.

GENERAL LITIGATION.

Forty-three cases not referable to any of the above classes were handled. Among these were eight suits for cancellation of patents to lands, in four of which decrees of cancellation were entered and four of which are pending. There were eight suits for forfeitures of easements, four of which resulted favorably to the Government and four of which are pending. Three suits were instituted to quiet title to lands which had been relinquished to the United States under the act of June 4, 1897 (30 Stat., 11), as base for the selection of lands elsewhere, and to cancel patents erroneously issued for the base lands. In two of these, decrees were entered for the United States, and one is pending decision on the testimony. Three similar cases were settled without litigation by the parties delivering to the Government quit-

claim deeds. A fine of $100 was imposed on C. J. Patton for using the mail in an attempt to sell base lands which had been relinquished to the United States. A suit begun by the Pacific Gas & Electric Co. to restrain the department from interfering with the construction of a pipe line across the Tahoe Forest is now pending decision. Demand upon a surety company for payment of damages occasioned by the failure of its principal to complete a contract for the cutting of timber resulted in the payment of the full amount, $600. The suit against the Telluride Power Co. to recover damages for the destruction of a Forest Service ranger station by the bursting of one of the company's reservoirs was settled by the payment of $776.22. The suit instituted by the Government against the Wagon Wheel Gap Improvement Co. of Colorado to restrain the closing of a road on the Colorado National Forest resulted in a compromise by which the company conveyed to the United States a right of way over its lands. The cross suits between the United States and W. L. La Motte, involving the use of the water in the Alder Creek, on the Okanogan National Forest, Wash., resulted in a consent decree whereby the United States secured a right to the use of such water as may be necessary for the purposes of a ranger station.

This office has assisted the defendant's attorney in the preparation of the defense in Cameron *v.* Bass, wherein it is sought to restrain a special use permittee of the department from occupying land, a location of which, under the mineral laws, had been canceled by the Interior Department. The matter is now pending. At the request of this department the Attorney General intervened on behalf of the United States in an important suit instituted during the year before the Interstate Commerce Commission by the Boise Lumber Co., involving freight rates on lumber of the Pacific & Idaho Northern Railway and the Oregon Short Line. The rates for lumber over these roads are so high as practically to forbid the purchase of large bodies of timber on the National Forests in Idaho. The case was pending at the close of the year. The significance of this litigation to the department is its direct bearing upon sales of National Forest timber.

COURT DECISIONS OF INTEREST.

In United States *v.* William R. Gibson (unreported), the federal district court in Wyoming decided that the repeal of the penalty section of the act of June 4, 1888 (25 Stat., 166), did not affect the act of June 4, 1897 (30 Stat., 11), which provides that violations of the latter or of regulations made thereunder shall be punished as prescribed by the former. In United States *v.* Utah Power & Light Co. (209 Fed., 554), it was held that after the passage of the act of May 14, 1896 (29 Stat., 120), no rights could be acquired under section 2339 of the Revised Statutes to rights of way for the storage or conveyance of water for the development of hydroelectric power. In United States *v.* Utah Light & Railway Co. (unreported), the Federal district court in Utah decided that the defendant, not having completed its power reservoirs and canals prior to the passage of the act of May 14, 1896, could not maintain them under section 2339 of the Revised Statutes.

THE WEEKS FORESTRY LAW (36 STAT., 961).

Completion by the Forest Service of the examination and survey of a larger total of areas than in any previous year, and new purchases authorized by the National Forest Reservation Commission of 259 tracts, aggregating approximately 391,114 acres, materially increased the work of this office incident to examination of titles and acquisition of the lands.

In Virginia, West Virginia, Tennessee, North Carolina, and South Carolina, progress in acquiring lands has been much retarded by the many defects found in titles and by the deplorable condition of early land records.

In each of the States last named, as well as in Georgia, it has been necessary to procure copies of all grants or patents, which may possibly affect the lands to be acquired, issued by the Crown before the organization of the States and by the States since that time. In order to accomplish this it has been necessary to place a force, usually under the supervision of a record examiner, at the capitol of each State. With a view to economy, it has been deemed advisable to obtain copies not only of grants lying directly within and adjoining the properties already authorized for purchase by the commission, but of all grants within or adjoining established areas approved by the Geological Survey in which future purchases are contemplated. While this has involved work and incidental expense somewhat in excess of immediate demands, it will eventually result in a great saving of both time and money.

The work of the office has also been materially increased by a closer cooperation with the Department of Justice. By reason of becoming thoroughly familiar with the complicated conditions of titles on which they prepare reports, the record examiners have been able to render the Department of Justice much assistance in its final examinations and in the preparation and presentation of cases where acquisition by condemnation is necessary. While the assistance so rendered has been an added burden on the force of this office, it has substantially expedited the accomplishment of the purposes of the Weeks forestry law and, it seems clear, has greatly reduced the ultimate expense to the Government incidental to the acquisition of the lands.

During the year three record examiners were assigned to consider and devise methods of reporting on titles, with the object of standardizing, in form and substance, the data to be presented by this department to the Department of Justice. The committee's report is under consideration by the Solicitor.

Appended is a summary of operations under the Weeks forestry law from the beginning to June 30, 1914.

State and area.	Purchases authorized.		Purchases completed.		Reports in Department of Justice.			
					For opinion.		For condemnation.	
	Number.	Acreage.	Number	Acreage.	Number.	Acreage.	Number	Acreage.
Georgia:								
Georgia	56	58,972	1	31,876			8	906
Savannah	91	37,655	1	231	4	8,090	16	5,137
New Hampshire:								
White Mountains	19	138,194	7	81,475			7	14,248
North Carolina:								
Mount Mitchell	69	60,144	10	14,099	5	2,088	3	10,836
Nantahala	71	37,014	22	25,468	4	432	9	3,614
Pisgah	1	86,700						
Savannah	68	37,944	1	100	6	13,523	1	600
South Carolina:								
Savannah	70	20,112			12	2,710		
Tennessee:								
Cherokee	8	124,134						
Smoky Mountains	3	64,490			2	61,662		
White Top	14	82,381	1	13,619			3	25,324
Unaka	13	19,756			3	4,197		
Virginia:								
Massanutten	61	62,468	2	11,787	2	231		
Natural Bridge	28	52,956	1	24,900				
Potomac	24	27,139						
Shenandoah	8	127,186						
West Virginia:								
Monongahela	6	42,887						
Potomac	33	7,395						
Shenandoah [1]	5				2	94		
Total	648	1,087,527	46	203,555	40	93,027	47	60,665

[1] Acreage computed in Shenandoah area, Virginia.

THE FOOD AND DRUGS ACT (34 STAT., 768).

Four hundred and thirty-six cases were transmitted to the Department of Justice, in 87 of which criminal proceedings, and in 349 of which seizure proceedings, were recommended.

At the close of the fiscal year 1913, 966 cases were pending in the courts, of which 785 were criminal prosecutions and 181 were seizures.

Four hundred and eighty-nine cases pending at the close of the fiscal year 1913, and 287 reported during the fiscal year 1914, in all 776, were terminated during the fiscal year 1914. Of those terminated, 407 were criminal and 369 were civil.

In 228 of the 407 criminal cases, fines were imposed; sentence was suspended in 16; in 1, the information was placed on file; in 2, demurrers to the informations were sustained; in 7, there were acquittals; in 58 there were nolle prosequis; 95 were withdrawn, dismissed, or barred by the statute of limitations. In a majority, pleas of guilty, nolo contendere, or non vult were entered. In 8, pleas of not guilty were entered and the defendants were convicted after trial.

In the criminal cases in which convictions were obtained the fines were as follows:

Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.
1	$1.00	$1.00	1	$40.00	$40.00	3	$200.00	$600.00
12	5.00	60.00	28	50.00	1,400.00	1	[1] 225.00	225.00
33	10.00	330.00	1	60.00	60.00	1	[2] 250.00	250.00
12	15.00	180.00	1	65.00	65.00	1	[3] 1,000.00	1,000.00
23	20.00	460.00	4	75.00	300.00	1	[4] 1,500.00	1,500.00
41	25.00	1,025.00	21	100.00	2,100.00			
4	30.00	120.00	1	125.00	125.00	[5] 192	.....	10,016.00
1	35.00	35.00	1	140.00	140.00			

[1] In this case there were three defendants, and each was fined $75.
[2] In this case there were two counts to the information.
[3] In this case a prior conviction was alleged.
[4] In this case there were 40 counts involving 19 different products.
[5] This number represents 228 cases reported to the Department of Justice, some of which were consolidated by the United States attorneys for trial.

In addition to the fines imposed, costs were generally assessed. Appeals by the defendants are pending in 3 cases and in 1 a petition for a writ of error is pending.

Of the 369 civil cases terminated during the year, decrees of condemnation and forfeiture were entered in 333; in 6 the libels were dismissed in the district courts after trial; in 18 libels were dismissed or the proceedings discontinued or dropped with the consent of the Government; and in 12 the packages were broken or disposed of before seizure could be made. In the 333 cases in which decrees of condemnation and forfeiture were entered, the goods were destroyed in 197; released on bond in 97 [1]; sold in 39.

At the close of the fiscal year, 626 cases were pending, of which 465 were criminal prosecutions, and 161 were seizures.

In addition to the cases reported by this department to the Department of Justice, the food and drugs officials of the various States and of the District of Columbia, collaborating with the department in the enforcement of the act, reported 51 cases to the different United States attorneys for action. Of those, 41 were criminal cases, and 10 were seizures. In all of the criminal cases, there were convictions, and in only one of these the defendant, a woman, was permitted by the court to go on her personal bond. Two of the seizure cases are pending in the courts; in 3, consent decrees were entered and the products released on bond; and in 5, default decrees of condemnation were entered and the products ordered destroyed. The fines in the criminal cases were as follows:

Number of cases.	Amount of fines.	Total.
5	$5.00	$25.00
33	10.00	330.00
1	15.00	15.00
1	20.00	20.00
40	.....	390.00

Eight hundred and two notices of judgment were prepared in this office.

[1] Writs of error to the United States Supreme Court pending in 2.

AMENDMENTS TO REGULATIONS.

This office cooperated with the Bureau of Chemistry, and with a joint committee appointed by the Secretary of the Treasury, the Secretary of Agriculture, and the Secretary of Commerce, in the preparation of important amendments to regulations 9 and 29.

Regulation 9, in effect, prohibits the use upon labels, on and after November 1, 1916, of the legend, "Guaranteed by —— under the Food and Drugs Act, June 30, 1906," and similar legends, heretofore authorized, and requires the cancellation of general guaranties filed with, and serial numbers assigned by, the department, on the ground that the use of the legends and numbers upon packages of food and drugs conveys the false and misleading impression to the public that the articles have been examined and approved by the Government and that the Government guarantees that they comply with the law.

Regulation 29, as amended, prescribes the manner and method of stating the quantity of the contents of foods in package form, required by the act of March 3, 1913 (37 Stat., 732).

CASES UNDER THE SHERLEY AMENDMENT.

The first cases involving the charge of misbranding under the Sherley Amendment (37 Stat., 416) were before the courts during the year. Two seizure cases were contested. In one, involving "Radam's Microbe Killer," there was a decree of condemnation and forfeiture, and an order of destruction (N. J. No. 3004). In the other, involving "Eckman's Alterative," exceptions to the libel, upon the ground that the Sherley Amendment is unconstitutional, were overruled (N. J. No. 2995). A writ of error was awarded by the Supreme Court, and the case is now pending there.

CASES OF INTEREST.

In United States *v.* Lexington Mill and Elevator Company (232 U. S., 399; Circular No. 79, Office of the Solicitor), the Supreme Court interpreted the provision of the food and drugs act by which an article of food is declared adulterated "if it contain any added poisonous or other added deleterious ingredient which may render such article injurious to health." It was held that an article of food is adulterated if, because of any added poisonous or deleterious ingredient, it may, by any possibility, injure the health of the strong or the weak, the old or the young, the well or the sick, or any of these; or, conversely, that an article of food is not adulterated, within the meaning of this provision, "if it can not by any possibility, when the facts are reasonably considered, injure the health of any consumer," even though it contain "a small addition of poisonous or deleterious ingredients."

In United States *v.* Antikamnia Chemical Company (231 U. S., 654; Circular No. 76, Office of the Solicitor), the Supreme Court sustained the validity of a regulation which requires that, in declaring the quantity or proportion of derivatives of any of the substances specified in section 8 of the food and drugs act, the name of the specified substance, in addition to the trade name of the derivative, shall be stated. It was held, further, that the act itself requires that the name of the specified substance be stated if the article contain a derivative of it.

In United States *v.* 40 Barrels and 20 Kegs of Coca-Cola (Circular No. 80, Office of the Solicitor), the Circuit Court of Appeals for the Sixth Circuit construed the provision of the food and drugs act by which an article of food is declared adulterated "if it contain any added poisonous or other added deleterious ingredient which may render such article injurious to health," and held that a mixture or compound sold under its own distinctive name is not adulterated because it contains, as one of its normal ingredients, a poisonous or deleterious substance, since such poisonous or deleterious substance is not added to the article within the meaning of the provision, but is a part of it.

In United States *v.* 13 Crates Frozen Eggs (208 Fed., 950; N. J. No. 2859), affirmed by the Circuit Court of Appeals for the Second Circuit on June 3, 1914 (N. J. No. 3411), it was held that the act prohibits the transportation in interstate commerce of frozen eggs, or eggs not frozen, so far decayed or decomposed that it may be said they consist "in whole or in part of filthy, decomposed, or putrid animal or vegetable substance," and that such eggs, which have not been denatured, may be seized and condemned, even if the shipper intended them to be used for tanning, not for food, purposes.

In Weeks *v.* United States (Circular 81, Office of the Solicitor), the Circuit Court of Appeals for the Second Circuit held that when a defendant appeared voluntarily, without issue of a warrant, a conviction might be had on an information signed and filed by the United States attorney, but not supported by the oath or affirmation of any person having knowledge of facts showing probable cause.

Among other cases of interest were the following:

United States *v.* Sweet Valley Wine Co. (208 Fed., 85; N. J. No. 3271).
United States *v.* Wells (N. J. No. 3306).
United States *v.* 5 Cases Champagne (205 Fed., 817; N. J. No. 3109).
United States *v.* Sprague et al. (208 Fed., 419; N. J. No. 3295).
United States *v.* Finlayson et al. (N. J. No. 2914).
United States *v.* Libby, McNeill & Libby (210 Fed., 148; N. J. No. 2938).
United States *v.* 36 Bottles London Dry Gin (216 Fed., 271; N. J. No. 2820).
Huyler's, a Body Corporate, *v.* Houston, Secretary of Agriculture (N. J. No. 3343).
United States *v.* 7 Cases Buffalo Lithia Water (Circular No. 78, Office of the Solicitor).

THE MEAT INSPECTION LAW (34 STAT., 679).

One hundred and fifty-four cases were reported to the Attorney General.

At the close of the fiscal year 1913, 62 cases were pending.

Of the cases reported during the fiscal year 1914, 78, and of those pending at the close of the fiscal year 1913, 42, in all 120, were terminated during 1914. Eighty-nine resulted in convictions, 9 were dismissed, in 16 the grand juries failed to return indictments, and in 6 verdicts were rendered for the defendants.

Two sentences of imprisonment were imposed, 1 of 4 months and 1 of 30 days, upon a defendant convicted of 6 violations. The jail sentence of 4 months was suspended upon payment of a fine of $200. In 5 cases sentences were suspended upon payment of costs.

Fines aggregating $3,097.50 were imposed in 78 cases, as follows:

Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.
3	$5.00	$15.00	2	$30.00	$60.00	2	$200.00	$400.00
1	7.50	7.50	7	50.00	350.00	1	500.00	500.00
11	10.00	110.00	1	65.00	65.00			
7	15.00	105.00	4	100.00	400.00	78	.....	3,097.50
3	20.00	60.00	1	150.00	150.00			
27	25.00	675.00	[1]8	[1] 200.00	200.00			

[1] In this case there were 8 violations and each of 2 defendants was fined $100.

At the close of the year 96 cases were pending.

Much time and attention was devoted, in cooperation with the Bureau of Animal Industry, to drafting the import meat regulations under the tariff act of October 3, 1913, and to revising all the regulations governing the meat inspection of the department.

This office assisted the Department of Justice in the defense of and preparation of briefs in two suits for mandatory injunctions against the Secretary of Agriculture and officers of the Bureau of Animal Industry.

In St. Louis Independent Packing Co. *v.* David F. Houston et al. (unreported), it was sought to restrain the department from refusing to mark complainant's sausage "Inspected and Passed." Complainant contended that the regulation, promulgated by the Secretary on February 28, 1913, limiting the use of the trade name "sausage," is unauthorized and void. The district court sustained the validity of the regulation, and refused a temporary injunction (204 Fed., 120). On appeal, the Circuit Court of Appeals for the Eighth Circuit reversed the district court and remanded the cause, with directions to issue a temporary injunction restraining the chief inspector of the Bureau of Animal Industry in charge of plaintiff's plant from refusing to mark complainant's product as "Inspected and Passed," upon the ground that it contained cereal in excess of 2 per cent or water in excess of 3 per cent, so long as it is marked "Cereal Added" or "Sausage and Cereal," as now or hereafter required by regulation of the Secretary of Agriculture, and that, if the Secretary of Agriculture shall hereafter require that the product shall be marked "Water Added," or with the amount of water added, the preliminary decree shall be subject to be modified accordingly. The case is pending for trial on its merits.

In Blanton Manufacturing Co. *v.* James J. Brougham et al. (unreported), the department was enjoined from refusing to mark as "Inspected and Passed" oleomargarine prepared and sold under the trade name "Creamo Oleomargarine." The question whether an appeal shall be taken is before the Attorney General.

THE TWENTY-EIGHT HOUR LAW (34 STAT., 607).

One thousand five hundred and forty-five cases were reported to the Attorney General.

At the close of the fiscal year 1913, 672 cases were pending.

Of the cases reported during the fiscal year 1914, 145, and of those pending at the close of the fiscal year 1913, 293, in all 438, were terminated during 1914.

Penalties aggregating $43,375 were recovered in 345 cases. Eighty cases were dismissed, and 13 were determined adversely to the Government.

The following is a detailed list of the number of cases prosecuted and amount of penalties assessed:

Number of cases.	Amount of penalty.	Total.	Number of cases.	Amount of penalty.	Total.
2	$50.00	$100.00	11	$250.00	$2,750.00
267	100.00	26,700.00	11	300.00	3,300.00
1	125.00	125.00	1	500.00	500.00
10	150.00	1,500.00			
42	200.00	8,400.00	345	.....	43,375.00

One thousand seven hundred and seventy-nine cases were pending at the close of the year.

DECISIONS OF THE COURTS.

Among the cases of interest decided during the year were:

Oregon-Washington R. R. & Nav. Co. *v.* United States (205 Fed., 337); United States *v.* Delaware, L. & W. R. R. Co. (206 Fed., 513); St. Louis Merchants' Bridge Term. Ry. Co. *v.* United States (209 Fed., 600); Mobile & Ohio R. R. Co. *v.* United States (209 Fed., 605); United States *v.* Chicago, Rock Island & Pac. Ry. Co. (211 Fed., 770); United States *v.* Union Pacific Railroad Co. (213 Fed., 332); and United States *v.* Northern Pacific Ry. Co. (unreported, decided by the district court of North Dakota, January 28, 1914).

ACTS REGULATING THE INTERSTATE MOVEMENT OF LIVE STOCK FROM QUARANTINED DISTRICTS AND PROHIBITING THE INTERSTATE MOVEMENT OF DISEASED LIVE STOCK (23 STAT., 31; 32 STAT., 791; 33 STAT., 1264).

Seven violations of the act of May 29, 1884 (23 Stat., 31), were reported to the Attorney General. At the close of the fiscal year 1913, 8 cases under this act were pending. Four cases reported during 1914, and 6 pending at the close of 1913, in all 10, under this act, were terminated during 1914. Five of the cases terminated favorably to the Government and fines were imposed, aggregating $1,330. One defendant was sentenced to serve 1 day in jail, in addition to payment of a fine of $100. In 1 case the grand jury failed to return an indictment, 2 cases were decided adversely to the Government, and 2 were dismissed. At the close of 1914, 5 cases under the act of 1884 were pending.

Two hundred and forty-four violations of the act of March 3, 1905 (33 Stat., 1264), were reported to the Attorney General. At the close of the fiscal year 1913, 66 cases under the act were pending. Fifty-six of the cases reported during 1914 and 43 pending at the close of 1913, in all 99, were terminated during 1914. Seventy-nine cases resulted in convictions; in 8, grand juries failed to return indictments; 12 were dismissed. In 7 cases sentences were suspended on payment of costs. Fines aggregating $8,350 were imposed in 72 cases. At the close of 1914, 211 cases under the act of 1905 were pending.

Three cases were reported to the Attorney General during the year under the act of February 2, 1903 (32 Stat., 791). In 2 of these the defendants pleaded guilty and were each fined $100, while in the other the grand jury failed to return an indictment. In another, brought over from the preceding fiscal year, the defendant pleaded nolo contendere. Fines were imposed in 3 cases, aggregating $300. No case under this act was pending at the close of the year.

The fines imposed in cases under the animal quarantine laws were—

Number of cases.	Amount of fine.	Total.
1	$30	$30.00
1	50	50.00
[1] 72	100	[1] 7,100.00
4	200	800.00
2	1,000	2,000.00
80	.....	9,980.00

[1] Fine of $100 was imposed on one defendant convicted of two violations.

Several orders of the Secretary of Agriculture establishing or changing quarantines under section 1 of the act of 1905 were examined as to their legal form and sufficiency. A number of sets of new regulations were likewise examined.

During the latter part of the year the question was raised, in the western district of Missouri, as to whether the act of 1905 applies to receivers of railroad companies. A demurrer to the indictment was sustained, and a writ of error was sued out to the Supreme Court, where the case was pending at the close of the year.

THE VIRUS ACT (37 STAT., 828).

Two apparent violations of the act of March 4, 1913 (37 Stat., 832), governing the preparation, shipment, and importation of viruses, serums, toxins, or other analogous products intended for use in the treatment of domestic animals, were reported to the Attorney General. These were the first cases reported under this law and were pending at the close of the year.

A representative of this office conducted a hearing at Kansas City, Kans., preliminary to the suspension of a license for failure of an establishment to conform to the requirements of the act and the regulations.

THE INSECTICIDE ACT (36 STAT., 331).

Ninety-seven cases were reported to the Attorney General, in 89 of which criminal proceedings, and in 8, seizures, were recommended.

There were pending at the close of the fiscal year 1913, 95 criminal cases and no seizures.

Fifty-four cases pending at the close of the fiscal year 1913, and 33 reported during the fiscal year 1914, in all 87, were terminated during the fiscal year 1914. Of the cases terminated, 83 were criminal and 4 were civil.

Of the 83 criminal cases terminated, fines were imposed in 65; sentences were suspended in 10; in 1 a demurrer to the information

was sustained; 7 were withdrawn or dismissed; and in 1 the grand jury failed to indict. In 48 pleas of guilty and in 27 pleas of nolo contendere or non vult were entered. In 2, after pleas of not guilty, the defendants were convicted.

In the criminal cases in which convictions were obtained the fines were as follows:

Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.
1	$0.50	$0.50	1	$75.00	$75.00
8	5.00	40.00	3	100.00	300.00
16	10.00	160.00	2	150.00	300.00
4	20.00	80.00	1	200.00	200.00
18	25.00	450.00			
11	50.00	550.00	65	.....	2,150.50

Costs were assessed in a considerable number of cases in which convictions were obtained.

Decrees of condemnation and forfeiture were entered in the 4 civil cases terminated during the year. In 1 there was a trial by jury and a verdict for the Government.

At the close of the fiscal year 101 cases were pending, of which 97 were criminal prosecutions and 4 were seizures.

During the year 80 notices of judgment were prepared in this office.

AMENDMENT TO REGULATIONS.

This office cooperated with the Insecticide and Fungicide Board in the preparation of an amendment to regulation 20. The regulation as amended prohibits the use upon labels, on and after November 1, 1916, of the legend "Guaranteed by —— under the Insecticide Act of 1910," and similar legends heretofore authorized, and requires the cancellation of the general guaranties filed with and serial numbers assigned by the department, upon the ground that the use of such legends and numbers upon packages of insecticides and fungicides conveys a false and misleading impression to the public that the articles have been examined and approved by the Government and that the Government guarantees them to comply with the law.

CASES OF INTEREST.

Among the cases of interest under the insecticide act terminated during the year were the following:

United States *v.* Powers, Weightman & Rosengarten Co. (211 Fed., 169; N. J. No. 75), in which it was held that the act was not violated by the shipment of an adulterated or misbranded insecticide from one point in the State of New York to another point in the same State, notwithstanding the goods passed through other States en route to destination.

United States *v.* Dr. E. Detchon Medicine Co. (N. J. No. 124) in which it was held that water is an "inert" ingredient within the definition of the insecticide act.

THE PLANT QUARANTINE ACT (37 STAT., 315).

Fifteen violations of the act of August 20, 1912, commonly called the plant quarantine act, were reported to the Attorney General for

prosecution. These were the first violations reported under this statute. All the cases were pending at the close of the year.

A number of orders of the Secretary of Agriculture establishing quarantines under the law were examined by this office as to their legal form and sufficiency. This office also assisted in the preparation of regulations promulgated during the year for the enforcement of the act.

THE LACEY ACT (35 STAT., 1137).

One hundred and eighty cases were reported to the Attorney General.

At the close of the fiscal year 1913, 98 cases were pending.

Of the cases reported during the fiscal year 1914, 118, and of those pending at the close of the fiscal year 1913, 85, in all 203, were terminated during 1914; 167 resulted in convictions; 32 were dismissed, and in 4, grand juries failed to return indictments.

In 161 cases fines aggregating $5,550.75 were imposed and paid. In 6 sentences were suspended. In 1 imposition of the penalty upon the defendant's plea of guilty was postponed to a succeeding term of court beyond the fiscal year.

At the close of the year there were pending 74 cases, in 51 of which indictments have been returned and in 23 of which United States attorneys have not commenced proceedings.

In the cases in which convictions were obtained, fines were as follows:

Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.
1	$1.00	$1.00	1	$30.00	$30.00	1	$65.25	$65.25
6	5.00	30.00	5	35.00	175.00	3	75.00	225.00
7	10.00	70.00	1	37.50	37.50	5	100.00	500.00
2	15.00	30.00	8	40.00	320.00	1	250.00	250.00
15	20.00	300.00	1	42.00	42.00			
69	25.00	1,725.00	35	50.00	1,750.00	161	.....	5,550.75

In addition to the fines, defendants were compelled to pay substantial costs.

PROTECTION OF BIRD PRESERVES LAW (35 STAT., 1104).

Section 84 of the penal code prohibits hunting, capturing, willfully disturbing, or killing any bird on lands of the United States which have been set aside as a breeding ground for birds. Only one instance of a violation of this section came to the attention of the department during the year. The defendant pleaded guilty and was fined $30.

THE MIGRATORY BIRD LAW (37 STAT., 847).

The act of Congress of March 4, 1913, became fully operative throughout the United States on October 1, 1913, by the approval and promulgation by the President of regulations adopted by the Department of Agriculture fixing closed seasons. Prosecutions for violations of the act were instituted in 14 cases, of which 13 resulted in convictions, in 7 of which fines were imposed aggregating $140, and in 6 of which sentences were suspended. In the prosecution of Alfred M. Shaw, in the District of South Dakota, which resulted in a plea of guilty and the imposition of a fine of $100, the court overruled

the defendant's contention that the law is unconstitutional, but no written opinion was delivered.

In United States *v.* Shauver (214 Fed., 154) a demurrer to the indictment, on the ground that the act is unconstitutional, was sustained. Motion on behalf of the Government for a rehearing was pending at the close of the year.

Regulations under the migratory bird law, prepared by the Biological Survey, which is in charge of the administration of the act, were examined and aid was given by this office in putting them into final form.

Numerous letters were written in this office replying to requests from various sections of the country for advice as to the interpretation of the regulations.

GENERAL STATUTES.

At the close of the previous fiscal year there were pending 11 cases of violations of the general criminal laws of the United States reported by this office to the Department of Justice. During the present year 6 such cases were reported by this office to that department. Of the cases reported this year, together with those coming over from previous years, 13 were disposed of during the year. In 4 of these the defendants could not be located and the cases were abandoned; 1 was dismissed; in 3, grand juries refused to indict; in 1, defendant was acquitted; and in 4, the defendants were fined $100 each upon pleas of guilty. At the close of the year 4 were pending in the courts.

AGREEMENTS FOR THE SEVERAL BUREAUS, OFFICES, AND DIVISIONS.

The following table shows the number of contracts, leases, and bonds prepared for the various bureaus, offices, and divisions of the department, in addition to those prepared for the Forest Service:

Bureau, office, or division.	Contracts.	Leases.	Bonds.	Bureau, office, or division.	Contracts.	Leases.	Bonds.
Bureau of Plant Industry	63	20	6	Bureau of Chemistry	5	4	1
Bureau of Animal Industry	12	10	3	Office of Experiment Stations	2	5	.....
Weather Bureau	34	28	.....	Bureau of Entomology	10	36	.....
Office of Public Roads	5	1	.....	Office of Chief Clerk	2	4	.....
Insecticide and Fungicide Board	4	1	.....	Bureau of Biological Survey	2	.....	1
Library	1	.....	.....				
Bureau of Soils	1	.....	.....	Total	141	109	12
Supply Division	.....	.....	1				

All of these contracts and leases were subsequently examined and passed upon by this office as to the legal sufficiency of their execution.

There were also prepared for the bureaus, divisions, and offices 241 renewals and 12 notices of terminations of contracts and leases, and 4 special bonds for property loaned for exhibition purposes.

PUBLICATIONS OF THE OFFICE.

The preparation of a compilation entitled "Federal Food and Drugs Act and Decisions" was completed during the year. The volume embraces the Federal food and drugs act and amendments, rules and regulations for the enforcement of the act, food inspection decisions, selected decisions of the courts, index-digest of the decisions of

the courts, the legislative histories of the act and amendments, the opinions of the Attorney General relating to the act, and other matters of interest to the public and to officers charged with the enforcement of the act. It will be distributed, in bound form, to all United States attorneys, United States judges, and other officials, Federal and State, and copies will be available for general sale by the Superintendent of Documents.

The preparation of a second supplement to "Laws Applicable to the United States Department of Agriculture" was undertaken during the year, to be completed as soon as possible after the adjournment of the present session of Congress.

An article on "Health Laws" was prepared for publication in the Yearbook of the Department of Agriculture for 1914, and was also distributed as a separate publication.

Under authority of section 4 of the food and drugs act and section 4 of the insecticide act of 1910 there were issued 670 notices of judgment.

During the year office circulars were prepared and issued containing decisions of the courts in the following cases under the food and drugs act:

United States *v.* Antikamnia Chemical Company (Supreme Court of the United States), Circular No. 76.

United States *v.* Seven Cases Buffalo Lithia Water (Supreme Court of the District of Columbia), Circular No. 78.

United States *v.* Lexington Mill and Elevator Company (Supreme Court of the United States), Circular No. 79.

United States *v.* 40 Barrels and 20 Kegs of Coca-Cola (Circuit Court of Appeals, 6th Circuit), Circular No. 80.

A circular giving the decision of the court in the following case under the twenty-eight hour law was also issued:

United States *v.* Northern Pacific Railway Company (District Court for the District of North Dakota), Circular No. 77.

REPORT OF THE INSECTICIDE AND FUNGICIDE BOARD.

UNITED STATES DEPARTMENT OF AGRICULTURE,
INSECTICIDE AND FUNGICIDE BOARD,
Washington, D. C., October 1, 1914.

SIR: I have the honor to submit herewith a report on the work of the Insecticide and Fungicide Board for the fiscal year ended June 30, 1914.

Respectfully,

J. K. HAYWOOD,
Chairman of Board.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

There was a large increase over the preceding year in the volume of work and results accomplished in connection with the enforcement of the insecticide act. There has been a notable increase in the number and quantity of insecticidal and fungicidal preparations on the market. The inspection force has covered the whole of the United States fairly well, and, in addition to the collection of samples and evidence of shipment, has obtained data which are of exceptional value in perfecting a more thorough and comprehensive scheme of inspection. The analysis and testing of official samples and the necessary investigational work have two general objects in view: (1) To determine whether or not shipments which come under the purview of the act are adulterated or misbranded; (2) to develop scientific information with a view to assisting manufacturers so that they may act in harmony with law. Many of the manufacturers affected have cooperated with the board. It has been found that by far the larger number of manufacturers desire to comply with the provisions of the law. The Service and Regulatory Announcements of the board, the publication of which began in February, supplied a medium for the dissemination of information of interest to the trade, especially in the nature of extracts from letters written by the board to individuals. These extracts are regarded as opinions of the board which might be of service to others than the particular correspondents to whom the letters were written. The public is not yet fully informed relative to the law and its requirements, and it was principally with the idea of supplying such information that the publication of Service and Regulatory Announcements was inaugurated.

GENERAL OUTLINE OF PROCEDURE.

To accomplish the work incidental to the enforcement of the insecticide act, a division into five subactivities has been made, as follows:

(1) Administrative work necessary in connection with the enforcement of the act.

(2) Chemical, microscopic, and bacteriological examination of insecticides and fungicides other than those used on horses, cattle, sheep, swine, or goats. This line of activity covers the examination of agricultural spraying materials, and the many proprietary preparations recommended for spraying purposes; products used to rid the household, garden, etc., of insects of all kinds; and disinfectants, germicides, etc., which are claimed to be efficacious to combat or kill bacteria.

(3) Testing the efficacy of fungicides and the action on foliage of insecticides and fungicides. This work involves the testing of official samples of agricultural spraying materials relative to their action on vegetation as to injurious effects and as to control of fungous diseases. The results of the tests, coupled with the previous work of the department, have not only been of value as evidence in the prosecution of cases in court, but have enabled the board to bring scientific information to the attention of manufacturers, with the result that many false and misleading fungicidal claims have been removed from labels, as well as directions for application which would result in serious injury to vegetation.

(4) Testing the efficacy of insecticides and action on foliage of insecticides. This work covers the testing of preparations which are recommended for use to prevent, destroy, repel, or mitigate insects of every species which frequent the household, infest vegetation, man, or other animals, etc. It also involves testing work relative to the injurious action of insecticides on vegetation and the testing of ingredients entering into the composition of insecticides to determine whether they are active or inert.

(5) Chemical and bacteriological examination of insecticides and fungicides used primarily on horses, cattle, sheep, swine, or goats, and efficacy tests of the same. This work covers the examination of animal dips, soaps and sprays, disinfectants for use primarily where animals are kept, and preparations for the treatment of certain bacterial and parasitic diseases that may infest the animals mentioned. The work also covers preparations used in connection with the treatment of bacterial and parasitic infections of other domestic animals, and investigations of the poisonous properties of various insecticidal and fungicidal preparations.

INTERSTATE SAMPLES.

During the fiscal year the board reported to the Solicitor of the department 112 cases presenting alleged violations of law and with recommendation that the facts be transmitted to the Attorney General to institute criminal or seizure action. Disposition was made of 152 cases by correspondence with the manufacturers. These cases presented violations which were technical only, were not at all flagrant, or cases in which the manufacturer gave reasonable and adequate explanation of his failure to conform to the provisions of the act. Action was taken to place in abeyance 603 samples which upon examination and test were shown to be in compliance with the provisions of the law, or were from shipments of the same goods made prior to shipments for which the manufacturers had been convicted and had after citation conformed to the requirements of the law. On June 30, 1914, 114 cases were pending preliminary hearings or

before the board for final action, 187 were held in temporary abeyance pending the receipt of further information or the outcome of prosecutions based on the same product, or correspondence with the manufacturers, and 859 samples were undergoing analysis and test.

The inspectors and sample collectors of the board, operating throughout the United States, collected 995 samples during the year. A general classification of the articles represented in the collection is as follows:

Samples collected.

	Number of samples.
Arsenate of lead	94
Arsenate and arsenite of zinc	5
Bordeaux mixture	53
Cyanide, potassium and sodium	8
Dips for animals	58
Disinfectants, bactericides, germicides	117
Disinfectants and insect killers, combinations of	27
Fly preparations for animals	60
Fish-oil and whale-oil preparations	14
Formaldehyde preparations	11
Hellebore and Pyrethrum powders	33
Insect preparations, household use	103
Kerosene emulsion	9
Lice and mite killers	54
Lime-sulphur solution and sulphur preparations	50
Nicotine preparations	51
Paris green	55
Miscellaneous	193

IMPORT SAMPLES.

During the year 147 official and unofficial import samples of insecticides and fungicides were collected by the various port laboratories of the Bureau of Chemistry for examination and test by the board. Disposition was made of 134 samples, 28 official samples being found adulterated or misbranded or both, and it was recommended that entry to this country be entirely forbidden or that the consignments be released when correctly labeled. The remaining samples were unofficial, 34 of them being found to be adulterated or misbranded or both, and in these cases it was recommended that future shipments be detained, while 72 were neither adulterated nor misbranded.

SPECIAL INVESTIGATIONS.

Various scientific investigations have been made by the board in cooperation with the various bureaus of the department to obtain basic facts to aid in the enforcement of the law.

The work on testing individual substances which enter into the composition of insecticides or fungicides, to determine whether they are active or inert against various classes of insects and fungi, has been continued, and data have been obtained which are not only absolutely essential in the enforcement of the act, but which are also of scientific interest.

Field work to determine the injury to vegetation by certain classes of insecticides and fungicides has been continued.

The investigation inaugurated last year relative to methods of determining the amount of powdered stems in pyrethrum (insect)

powder and of sand in pyrethrum powder is practically completed, and the data are being prepared for publication. A method has been developed for determining with accuracy the presence and approximate amount of pyrethrum stems in commercial insect powder, and data have been obtained which will enable us to adopt a stem-and-sand standard for such powders.

The work on the determination of alkaloids and dirt in powdered white hellebore, for the purpose of developing the best method of examination and establishing standards for this product, has been continued from last year as time permitted.

Comparative studies of known chemical methods for determining the constituents in various complex insecticidal and fungicidal mixtures have been conducted, and new methods for analyzing certain such complex mixtures have been developed. An electrolytic method for the determination of zinc in zinc arsenite and other products containing zinc has been developed, which greatly simplifies this previously difficult and tedious determination. Electrolytic methods have also been developed for the separation and determination of iron and copper in the presence of arsenic. The results of this work have been presented for publication under the title, "Electrolytic Separation of Zinc, Copper, and Iron from Arsenic."

The study of the preparation and properties of the various lead arsenates, which has been under way from time to time for the last two years, has led to the discovery of facts of considerable scientific interest. It is also hoped that ample information has been obtained, or soon will be obtained, to enable the board to determine how such commercial products appearing on the market should be labeled.

During the year the board has made an extended investigation of the soda-lye trade and methods of manufacture of soda lye, to enable the board to answer questions relative to labeling which were asked by the manufacturers.

Further field and laboratory work relative to the effect on foliage of Paris green containing varying amounts of arsenic in water-soluble forms and the development of a better laboratory method by which this constituent can be determined have been continued.

Investigational studies and experimental tests have been undertaken and completed relative to the poisonous action and bactericidal efficiency of various members of the phenol group which are ingredients of certain coal-tar creosote dips and disinfectants. The results obtained are of great value to the board in connection with the enforcement of the act.

REPORT OF THE FEDERAL HORTICULTURAL BOARD.

UNITED STATES DEPARTMENT OF AGRICULTURE,
FEDERAL HORTICULTURAL BOARD,
Washington, D. C., September 29, 1914.

SIR: I submit herewith an executive report covering the administration of the plant quarantine act for the fiscal year ended June 30, 1914.

Respectfully,

C. L. MARLATT,
Chairman of Board.

HON. D. F. HOUSTON,
Secretary of Agriculture.

FEDERAL PLANT QUARANTINE ACT.

Under the Federal plant quarantine act of August 20, 1912, the entry of foreign nursery stock and other plants and plant products into the United States is regulated, and domestic and foreign quarantines on account of plant diseases and insect pests are established and maintained.

ADMINISTRATION AND PERSONNEL.

FEDERAL HORTICULTURAL BOARD.

The personnel of the Federal Horticultural Board, which administers the act, remained the same as last year, viz:

C. L. Marlatt, chairman, Bureau of Entomology; W. A. Orton, vice chairman, Bureau of Plant Industry; George B. Sudworth, Forest Service; W. D. Hunter, Bureau of Entomology; A. V. Stubenrauch, Bureau of Plant Industry. R. C. Althouse, secretary of the board, has charge of the administrative office.

FEDERAL AND STATE INSPECTION SERVICE.

The Federal and State inspection service remains substantially the same as last year, the Federal work having been under the charge as heretofore of Mr. E. R. Sasscer and Mr. Perley Spaulding. The number of State expert inspectors appointed as collaborators remains substantially the same as last year. The great bulk of the nursery stock and other plant importations enters through the port of New York, and it has been found necessary to place a permanent inspector at this port. Mr. H. B. Shaw has been transferred to this work from the Bureau of Plant Industry of this department. His duties relate particularly to the inspection of plant importations from countries

without inspection service and the inspection of potatoes and avocados offered for entry under the regulations requiring inspection.

Some work now completed, in part continued from last year, has been necessary in foreign countries, partly in the nature of inspection and partly investigative. Such work in relation to foreign quarantines is necessarily of an emergency character and temporary.

Similar field examinations and investigations have been necessary in connection with some of the domestic quarantines. This work has been, for the most part, done in cooperation with the Bureaus of Entomology and Plant Industry by special expert agents detailed from these bureaus.

COOPERATION WITH OTHER DEPARTMENTS.

The State, Treasury, and Post Office Departments have continued their hearty cooperation in carrying out the provisions of the plant quarantine act, and in enforcing the several domestic and foreign quarantines which have been established thereunder. In the case of the Treasury Department the foreign quarantines have very materially increased the duties of the customs officers, and the assistance rendered by these officials has been of the greatest value. The Consular Service of the State Department has been utilized in enforcing foreign plant quarantines, by refusing to certify invoices of shipments of quarantined articles intended for the United States, and the cooperation of foreign governments has also been effected through the State Department.

Through the cooperation of the Post Office Department the interstate shipment by mail of plants and plant products covered by our domestic quarantines, unless properly inspected and certified, has been prevented. In the last report attention was called to the signal service rendered by the Post Office Department in prohibiting the importation of "nursery stock," as defined in the act, in the mails from foreign countries on and after July 1, 1913, except as to plants addressed to or ordered by and intended for the United States Department of Agriculture, Washington, D. C. This action was taken by the Post Office Department under its own authority at the request of the Department of Agriculture, for the reason that it is utterly impracticable for the State inspectors to follow up and examine the small mail shipments of plants which may arrive at any one of the many thousand post offices in the United States. It was found, however, that foreign shippers, and postmasters as well, were quite unable to make the distinction between "nursery stock" and "herbaceous plants," and that a considerable quantity of nursery stock was still being mailed under the designation "herbaceous plants." To put an end to the frequent and probably unwitting violation of the post-office order, the Second Assistant Postmaster General, at the request of this department, December 16, 1913, amended the former order by extending the prohibition against mail shipments to all plants and plant products for propagation, with the exception of field, vegetable, and flower seeds. While this restriction of the use of the mails necessarily results in occasional inconvenience, the protection to the country as a whole fully justifies the action taken.

REVIEW OF THE WORK OF THE YEAR.

NEW PLANT QUARANTINES AND RESTRICTING ORDERS.

The domestic and foreign quarantines described below are additional or supplementary to the quarantines reported last year.

FOREIGN QUARANTINES.

PINK BOLL WORM OF COTTON.—Amendment 1 to Quarantine No. 8, promulgated August 18, 1913, and providing, under regulation, for the entry from the States of Nuevo Leon and Tamaulipas, Mexico, of cotton seed (including seed cotton) and cottonseed hulls grown in the Rio Grande Valley in the States named.

Amendment 2 to Quarantine No. 8, promulgated June 17, 1914, and providing, under regulation, for the entry from the States of Coahuila, Durango, and Chihuahua, Mexico, of cotton seed (including seed cotton) and cottonseed hulls grown in the States named. The regulations in this amendment supersede all prior regulations governing the importation of cotton seed from Mexico.

POTATO QUARANTINE.—This is Quarantine No. 11, promulgated December 22, 1913, to prevent the introduction into the United States of the disease known as powdery scab (*Spongospora subterranea*) and forbids the importation into the United States, from the Dominion of Canada, Newfoundland, the islands of St. Pierre and Miquelon, Great Britain, Ireland, and Continental Europe, of the common or Irish potato (*Solanum tuberosum*), until such time as it shall have been ascertained to the satisfaction of the Secretary of Agriculture that the country or locality from which potatoes are offered for import is free from powdery scab and other injurious potato diseases.

Amendments 1, 2, and 3 to Quarantine No. 11, promulgated February 20, 1914, February 20, 1914, and March 12, 1914, respectively, eliminating the Kingdoms of Belgium, Denmark, and the Netherlands from the provisions of Quarantine No. 11, and making it possible to import potatoes from these countries in accordance with the regulations prescribed under the order of the Secretary of Agriculture of December 22, 1913, governing the admission of foreign potatoes under restriction.

Amendment 4 to Quarantine No. 11, promulgated June 25, 1914, providing for the elimination of the Territory of Porto Rico from the provisions of Quarantine No. 11 and the regulations governing the importation of potatoes into the United States.

AVOCADO SEED QUARANTINE.—This is Quarantine No. 12, promulgated February 27, 1914, to prevent the introduction into the United States of the avocado weevil (*Heilipus lauri*), and forbids the importation into the United States of the seeds of the avocado or alligator pear from Mexico and the countries of Central America.

SUGAR CANE QUARANTINE.—This is Quarantine No. 15, promulgated June 6, 1914, to prevent the introduction into the United States of injurious insects and fungous diseases of the sugar cane, and forbids the importation into the United States from all foreign countries of living canes of sugar cane, or cuttings or parts thereof. This quarantine does not apply to Hawaii and Porto Rico.

DOMESTIC QUARANTINES.

Under the provisions of section 8 of the plant quarantine act, the following domestic plant quarantines have been established:

MEDITERRANEAN FRUIT FLY AND MELON FLY.—This is Quarantine No. 2, promulgated September 18, 1912, and revised and amended as Quarantine No. 13, promulgated March 23, 1914, to protect the United States from the entry of the Mediterranean fruit fly (*Ceratitis capitata*) and the melon fly (*Dacus cucurbitæ*), now thoroughly established in the Hawaiian Islands. This quarantine prohibits the shipment of any of the fruits, nuts, and vegetables specified in the notice of quarantine into or through any other State, Territory, or District of the United States, with the exception of bananas and pineapples, which may be moved only in accordance with the regulations prescribed under this quarantine. This quarantine became effective May 1, 1914.

POWDERY SCAB OF POTATOES.—This is Quarantine No. 14, promulgated April 25, 1914, to prevent the further distribution in the United States of the dangerous potato disease known as powdery scab (*Spongospora subterranea*), which exists in certain portions of the State of Maine. This quarantine will become effective August 1, 1914.

SUGAR CANE QUARANTINE.—This is Quarantine No. 16, promulgated June 6, 1914, to prevent the further distribution in the United States of certain injurious insects and fungous diseases of the sugar cane existing in the territories of Hawaii and Porto Rico, and forbids the movement from the Territories named into or through any other State, Territory, or District of the United States of living canes of sugar cane, or cuttings or parts thereof.

ORDERS RESTRICTING THE ENTRY OF POTATOES AND AVOCADOS.

Under the authority given by section 5 of the plant quarantine act, orders placing restrictions on the importation of potatoes and avocados have been promulgated.

The order restricting the admission of all foreign potatoes not under quarantine was issued December 22, 1913, and regulations governing the entry of potatoes under this order into the United States were issued December 30, 1913. This order specifies that potatoes may be imported only from countries which are free from injurious potato diseases and insect pests and under permit and prior foreign inspection and certification. All such imported potatoes are subject to a second inspection by a Federal inspector on their arrival in this country.

The order governing the admission of the avocado or alligator pear under restriction was issued February 27, 1914. These two orders are supplemental to the quarantine orders described above in relation to the potato and to avocado seed.

ENFORCEMENT OF DOMESTIC AND FOREIGN QUARANTINES AND RESTRICTIVE ORDERS.

Domestic quarantines provide in general for the movement of the quarantined articles under a system of inspection and certification. Of the several domestic quarantines now in force, two only

necessitate much expenditure for inspection and certification. These are the gipsy moth and brown-tail moth quarantine, covering most of the New England States, and the Mediterranean fruit-fly quarantine, covering the Hawaiian Islands. The cost of the administration of these two quarantines is met from special appropriations by Congress in relation to these two problems. The material cooperation and assistance of State inspectors and authorities of the New England and Pacific Coast States, respectively, has been continued. Some necessary extensions have been made in the quarantine lines of New England, and some additional regulations and safeguards have been placed about the movement of fruit from the Hawaiian Islands.

Foreign quarantines prohibit the entry of the goods covered, and entail very little expense and difficulty in enforcement as a result of the hearty cooperation of the customs service. Commercial importations are not possible nor attempted, and small shipments of the quarantined articles sent in ignorance of the law are stopped by customs officers and destroyed or returned to the country of origin.

The enforcement of the orders providing for the entry of foreign potatoes and avocados under restriction necessitates examinations at the port of entry, with certain resulting expense. This expense is reduced to a minimum by limiting entry practically to the port of New York, which is, furthermore, the main port of arrival for these two articles.

NURSERY STOCK IMPORTATIONS.

The control of imported nursery stock established last year has been continued without material change.

FOREIGN COUNTRIES MAINTAINING INSPECTION SERVICE.

The following countries have provided for inspection and certification in conformity with the regulations under the plant quarantine act:

Australia.
Barbados.
Belgium.
Bermuda.
British Guiana.
Canada.
Cuba.
Denmark.
England.
France.
Germany.
Guatemala.
Holland.
Ireland.
Italy—Province of Padova (Padua) only.
Japan.
Leeward Islands:
  Antigua.
  St. Christopher-Nevis.
  Dominica.
  Montserrat.
  Virgin Islands.
Grand Duchy of Luxemburg.
New Zealand.
Scotland.
Union of South Africa.
Straits Settlements.
Switzerland.
Trinidad.
Wales.
Windward Islands:
  Granada.
  St. Lucia.
  St. Vincent.

Italy expects to have an inspection service in operation for the entire country early next fall.

This list includes practically all of the countries which have hitherto maintained any considerable commercial trade in nursery stock with the United States. Any other country may obtain the privilege of commercial exportation to the United States by providing an inspection service.

In the main, the importers and exporters of nursery stock have endeavored to comply with the law and meet all of its conditions, and in only a few instances was it necessary to return shipments of nursery stock or to destroy the stock on account of infestation.

DISTRIBUTION OF IMPORTED NURSERY STOCK, BY STATES.

The following table indicates the distribution, by States, of nursery stock imported during the fiscal years 1912–13 and 1913–14:

Distribution of imported nursery stock, by States.

State.	Number of cases.		State.	Number of cases.	
	1913–14	1912–13		1913–14.	1912–13.
Alabama	425	278	Montana	26	12
Arizona	4	2	Nebraska	149	100
Arkansas	11	24	Nevada	2	.....
California	1,929	1,144	New Hampshire	57	63
Colorado	152	144	New Jersey	10,458	7,966
Connecticut	1,432	1,177	New Mexico	1	1
Delaware	38	29	New York	12,363	11,521
District of Columbia	562	774	North Carolina	162	167
Florida	56	57	North Dakota	8	1
Georgia	196	160	Ohio	3,068	2,475
Hawaii	4	.....	Oklahoma	13	7
Idaho	9	12	Oregon	560	244
Illinois	3,942	2,977	Pennsylvania	9,309	6,540
Indiana	545	510	Rhode Island	606	404
Iowa	394	422	South Carolina	41	15
Kansas (north)	48	238	South Dakota	16	9
Kansas (south)	286		Tennessee	200	124
Kentucky	352	204	Texas	184	109
Louisiana	416	329	Utah	35	8
Maine	51	29	Vermont	20	36
Maryland	553	404	Virginia	338	153
Massachusetts	5,115	3,602	Washington	482	200
Michigan	1,232	851	West Virginia	102	248
Minnesota	528	314	Wisconsin	334	221
Mississippi	35	25			
Missouri	676	451	Total	57,525	44,781

COUNTRY OF ORIGIN AND NATURE OF NURSERY-STOCK IMPORTATIONS.

Country of origin and classes of plants and seeds imported during the year ended June 30, 1914.

Country.	Fruit trees.	Fruit-tree stocks.	Grape-vines.	Bush fruits.	Roses.	Rose stocks.	Forest and ornamental deciduous trees.	Ornamental deciduous shrubs.	Coniferous trees other than pines.	Pines.	Evergreen trees.	Evergreen shrubs.	Field-grown florists' stock.	Stocks, cuttings, or seedlings.	Tree seeds.	Avocado seeds.
															Pounds.	*Pounds.*
Algeria													22,985			
Australia				2,000												
Austria			101													
Azores					6											
Belgium	8,500			1,010	9,826		13,299	263,730	50,043		54,440	218,308	101,460	275	165,000	
Bermuda					6			37	2				5,021			
Brazil													42,994		238,405	
Canada	35,881						1,300		1,000				5			
China	20															
Colombia													108,522			
Costa Rica													28			
Cuba													2,157		871	
Denmark								2,272					200			
Fiji Islands													2			
England	13,572		115	27,693	41,327	2,083,000	15,194	25,718	7,604	400	8,007	20,015	24,640			
France	6,692,260	14,391,766	122,875	66,160	318,625	1,022,450	1,096,798	3,229,535	571,398	48,740	452,246	278,858	426,259	306,217	2,073	
Germany	66,269			1,362	33,419		67,063	8,378	229	20	18	8,416	9,012		1,049	
Grand Duchy of Luxemburg					11,458											
Greece			1,031													
Guatemala	1												876			
Holland	903,681	231,700	1,775	10,714	1,439,718	92,925	380,172	556,819	202,995	5,914	50,451	576,158	149,932			
Ireland				48	43,256	193,000	56		280			137	56			
Italy	19		5,440					30					730		1,570	
Jamaica											5					
Japan	8,993	6,200	1,670	6	250	5	4,014	2,637	8,359	2,905	1,623	2,406	56,397	1,700	1,410	
Mexico													189			1,592
New South Wales															32	
New Zealand													353			
Nova Scotia									25	3		5				
Panama													756			
Philippine Islands													31,102			
Scotland	296		56	144	5,765	165,000	45,306	21	3			1,173	56			
Switzerland					51											
Trinidad													1,707	15		
Venezuela													135,244			
Total	7,809,502	14,629,666	133,063	109,137	1,903,707	3,556,380	1,623,202	4,089,177	841,938	57,982	566,790	1,105,471	1,120,483	308,207	718,617	1,592

INSPECTION OF IMPORTED NURSERY STOCK.

As pointed out last year, the plant quarantine act contemplates that the actual examination of commercial importations of nursery stock shall be made by State officials and at State cost, and unless this examination is made by such State officials such stock must necessarily go without inspection. Unfortunately, some States have not been able to inspect all of the foreign nursery stock consigned to them, and one or two States have made no provision or have neglected to make proper inspections. Fortunately, the States concerned are not horticulturally important. Nevertheless, if insects or diseases gain foothold in these States, the general spread of such enemies is only a question of time.

The examination of noncommercial importations of nursery stock from countries which do not maintain nursery-stock inspection is, under the provisions of the act, made at the port of entry by inspectors of this department, and, therefore, the inspection of such nursery stock is under our full control. The importations, however, of this class are not of large amount.

As in the past, all importations made by the Department of Agriculture have been subjected to a rigid inspection, and where necessary such material has been held in quarantine or destroyed, as the conditions warranted. With one exception, all of the department's experimental gardens were inspected, both for diseases and for insects.

To keep the State inspectors and their assistants thoroughly familiar with the pests collected on imported stock, a monthly news letter is issued, listing all reported insects and diseases.

RESULTS OF STATE AND FEDERAL INSPECTION OF IMPORTED PLANTS AND PLANT PRODUCTS.

As a result of State and Federal inspection, the following recognized pests were intercepted on imported plants and plant products during the year: Fourteen instances of brown-tail moth infestation have been reported on nursery stock originating in France, and two instances of egg masses of the gipsy moth, one from Japan and one from Belgium. Two shipments of Egyptian cotton seed were found to be infested with the pink boll worm (*Gelechia gossypiella*). Fertile eggs of an undetermined tree hopper were detected on eight shipments of cuttings from China. Adults of the olive fruit fly (*Dacus oleae*) were collected in a box of olive seed from Cape Town, South Africa, and puparia of the papaya fruit fly (*Toxotrypana curvicauda*), from which adults were reared, were found attached to an unknown vine from Mexico. Shipments of potatoes from Peru, Bolivia, and Chile were found to be infested with no less than two species of potato weevils (*Premnotrypes solani* and *Trypopremnon latithorax*) which are new to the United States. These are in addition to the related potato weevil (*Rhigopsidius tucumanus*) referred to in last year's report as infesting potatoes from Peru. The citrus leaf miner (*Phyllocnistis citrella*), considered especially injurious to young nursery stock in the Orient, was detected on citrus plants from the Philippine Islands. The European tussock moth (*Notolophus antiqua*) and the oriental moth (*Cnidocampa flavescens*) have been reported on a number of occasions as entering on imported stock. In addition to the above, many scale insects of greater or less importance have been found on plants of

various descriptions. In all, some 191 species of insects have been reported on imported stock.

Potatoes from Holland, Belgium, and Denmark, on inspection at the port of entry, were found to be infected with the powdery scab (*Spongospora subterranea*). In addition to this injurious potato disease some 54 fungous diseases affecting miscellaneous shipments have been detected.

All of the pests enumerated above, the entry of which has been prevented, are capable of becoming very important enemies of our crops, but, on account of the great value of the crops involved, the prevention of the entry of the seriously infested Egyptian cotton seed and of disease and insect-infested potatoes is especially important, and these latter items, therefore, deserve explanation.

INFESTED EGYPTIAN COTTON SEED.

The danger from the so-called pink boll worm led last year to the promulgation of Quarantine No. 8, generally prohibiting the importation into the United States of cotton seed. The urgent need of this quarantine was early shown in the present year by the detection and holding by customs officials of several small shipments of cotton seed offered for entry at the ports of New York and Boston. This cotton seed was forwarded to the Department of Agriculture and examined prior to being destroyed by burning and proved to be badly infested with the pink boll worm, an insect which is now doing more damage in Egypt than all other cotton-insect pests combined, and which, fortunately, has not yet gained a foothold in this country. Its partly grown larva lives in the cotton seed, and is thus easily transported. Greater seriousness has this year been added to the problem by the discovery that, owing to imperfect ginning, some cotton seed remains in baled Egyptian cotton, the average of seed per bale being about 215. While the great majority of the larvæ in the seed contained in such baled cotton have apparently been killed by compression or other causes, a number of living worms in seeds have been found, indicating a distinct danger from the use of such baled cotton, particularly in southern mills, which are often situated in the midst of cotton fields. A public hearing was held in May, 1914, to discuss the regulation of the transportation and use of foreign lint cotton in order to protect southern cotton growers from the pink boll worm. Final action has been deferred awaiting the result of experiments now under way in this department, in cooperation with the Bureau of Standards, to determine the practicability of treating baled Egyptian cotton to destroy all contained insect life. In the meantime all mills using imported Egyptian cotton have been requested to destroy by burning at the close of each day all picker waste and seeds from such cotton. Assurances of compliance with this request have been received from practically every mill using such cotton.

Correspondence has been had also with Mr. Gerald C. Dudgeon, consulting agriculturist and minister of agriculture at Cairo, Egypt, with a view to getting the Egyptian authorities to adopt some method of baling or treating cotton to eliminate the danger at the country of origin. In a recent communication Mr. Dudgeon states that he is again bringing the matter before the Alexandria shippers.

POWDERY SCAB OF THE POTATO.

Quarantine No. 11, described above, prohibited the importation into the United States of potatoes from the Dominion of Canada, Newfoundland and adjacent islands, and Europe. Provision was made, however, for the lifting of this quarantine as to any of the countries quarantined when such country could show a clean bill of health in relation to powdery scab and other injurious potato diseases. The necessity of this quarantine action was early shown by the passage through the port of New York of large shipments of potatoes from Ireland, en route to Cuba, which, on request, were examined by an inspector of this board and found to be generally and badly infested with the powdery scab.

As a result of representations made by the Kingdoms of Belgium, Denmark, and the Netherlands the quarantine was raised as to these countries and the importation of potatoes therefrom was permitted, in accordance with regulations under the order of the Secretary of Agriculture of December 22, 1913, governing the admission of foreign potatoes under restriction.

The first importation of Belgian potatoes after the lifting of this quarantine was found by our inspector at the port of entry to be infected with powdery scab, and it became necessary, in accordance with our regulations, to cancel all permits for the importation of potatoes from Belgium and to refuse entry to the Belgian potatoes. The potatoes from Denmark have been free from infection, with the exception of some potatoes from the island of Bornholm. This led to similar action in the case of Denmark. Subsequently, the Government of Denmark arranged to refuse to certify shipments from the island of Bornholm, and the entry of potatoes from other regions of this country is now permitted. In the case of the Netherlands it developed that the Provinces of Groningen and Drenthe were more or less affected with powdery scab, and a similar arrangement has been entered into with that country, namely, that no potatoes from these Provinces will be certified for export to the United States. The importation, therefore, of European potatoes into the United States is limited at the present time to Denmark, except the Island of Bornholm, and the Netherlands, except the Provinces of Groningen and Drenthe. It may be possible in the near future to lift the quarantine as to certain Canadian Provinces. The importation of potatoes under the restrictions of the order of December 22, 1913, is also now permitted from the Bermuda Islands and the Mexican States of Sonora and Chihuahua.

NEW POTATO WEEVILS.

The three potato weevils found during the last two years infesting small shipments of potatoes from Peru, Bolivia, and Chile are an entirely new form of potato pest. These weevils totally destroy the potato tuber and could easily cause tremendous losses in this country. The fact that they were found in wild potatoes from the region in which the potato plant is supposed to have originated is significant as indicating that they are natural and historic enemies of this plant. The greatest care will be taken to see that these new pests do not gain entrance, and no potatoes from this region will knowingly be allowed entry into the United States.

REGULATORY INVESTIGATIONS.

FOREIGN INVESTIGATIONS.

The investigation of fruit-fly conditions in Mediterranean countries, conducted by Prof. H. J. Quayle, of the University of California, referred to in the last report, has been completed. The lemon is the important fruit product received from Mediterranean regions, and Prof. Quayle's investigations have demonstrated that there is little danger of the introduction of the Mediterranean fruit fly with this fruit. Prof. Quayle's report is in process of publication.

Dr. H. W. Wollenweber, an employee of the Bureau of Plant Industry, had been commissioned to make a study in European countries of certain plant diseases for that bureau, and his services were utilized to determine the range of powdery scab in European countries in connection with the potato quarantine.

A thorough inspection of Sonoran citrus cultures was made for the board by Mr. R. S. Woglum, of the Bureau of Entomology, as a basis for the permission subsequently granted for the shipment of Sonoran oranges in bond over a specified route through the United States to Canada, and through a portion of the United States for reentry into Mexico.

In response to urgent requests, in view of the fact that the Mexican authorities were not able at the time to make official inspections, an agent of the Bureau of Plant Industry, Mr. O. A. Pratt, conducted for the board a thorough examination of the potato-producing areas in Chihuahua and Sonora. The freedom from serious disease shown by this inspection enabled the board to permit the exportation of these potatoes into the Southwest for local consumption, under a modification of the regulations issued with order of December 22, 1913, covering the entry of foreign potatoes.

DOMESTIC INVESTIGATIONS.

The investigations necessary to the determination of quarantine lines and as a basis for proper regulatory action in connection with domestic quarantines have been conducted in cooperation with the Bureau of Plant Industry in relation to the potato quarantine, and in cooperation with the Bureau of Entomology in relation to the moth quarantine in New England and the Mediterranean fruit-fly quarantine in Hawaii. The other domestic quarantines have been of minor importance and have not called for any special investigations.

REPORT OF THE CHIEF OF THE OFFICE OF MARKETS.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF MARKETS,
Washington, D. C., October 1, 1914.

SIR: I have the honor to submit herewith a report of the work of the Office of Markets for the fiscal year ended June 30, 1914.

Respectfully,

CHARLES J. BRAND,
Chief of Office.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

OUTLINE OF WORK FOR THE YEAR.

In the act making appropriations for the Department of Agriculture for the fiscal year ended June 30, 1914, the following paragraph was included among the miscellaneous appropriations:

> To enable the Secretary of Agriculture to acquire and to diffuse among the people of the United States useful information on subjects connected with the marketing and distributing of farm products, and for the employment of persons and means necessary in the city of Washington and elsewhere, there is hereby appropriated the sum of $50,000, of which the sum of $10,000 shall be immediately available.

Under this authority the Chief of the Office of Markets was appointed on May 16, 1913. During the summer and fall of 1913 plans relating to the scope and nature of the investigational work of the Office of Markets were outlined, and the nucleus of a scientific staff was formed after several special competitive examinations had been held by the Civil Service Commission. Appointments were drawn for two specialists in cooperative organization, a specialist in transportation of farm products, two investigators in the marketing of perishable products, and assistants in cooperative organization accounting, cotton marketing, and cottonseed marketing and utilization. In the spring of 1914 a specialist in marketing live stock, meats, and meat products, and a specialist in marketing dairy products were added to the staff, and various scientific and other assistants have been appointed from time to time.

From the first the correspondence of the office has been relatively heavy, and has been increasing in volume constantly. General and specific requests for information, suggestions, and advice have been received, and, with the replies thereto, have constituted a large part of these communications.

Two Department Bulletins and one Farmers' Bulletin, as well as articles in other Farmers' Bulletins, have been issued, containing in all 117 pages.

COTTON HANDLING AND MARKETING.

The work under this project has developed into several distinct lines, prominent among which are the surveys of primary markets, the promotion of cooperative methods of handling and selling among growers, detailed comparative spinning tests upon typical bales of different varieties of cotton calculated to determine their relative desirability for exclusive community production, and the study of specific economic problems relating to various phases of the industry.

The cotton handling and marketing investigations have been conducted in cooperation with the Bureau of Plant Industry.

The results of the detailed survey made in Oklahoma in the preceding year were published in Department Bulletin 36, Studies of Primary Cotton Market Conditions in Oklahoma, and with the opening of the new cotton season a comprehensive survey of primary cotton markets was undertaken, embracing practically the entire belt, and involving the sampling of more than 30,000 bales of cotton. The samples were taken simultaneously in all the markets on the same days of each week, a record was made of the price at which each bale was sold, and the samples were assembled for grading in Oklahoma City and in Washington, respectively. This survey, which was probably more comprehensive than any ever undertaken in relation to the cotton industry, has brought together a collection of samples which show in greater detail the qualities of cotton produced in various parts of the belt than does any other collection known to exist. A very large amount of work has been done in tabulating and digesting the data secured in this survey, and publications giving certain portions of the results are in course of preparation. The information secured as to the exact proportion of the various grades produced, and as to the staple lengths of the so-called short cotton of various parts of the belt, as well as on the lack of relation between grade and price, is very complete.

In connection with the lint-cotton survey there were collected in the State of Oklahoma a large number of samples of seed cotton, with records of the prices paid to producers when sold before ginning. These samples were also taken uniformly from the purchases made by the gins on Monday of each week. The samples were later ginned in Washington under uniform conditions. The relative percentage of lint and the grade of each sample was determined for comparison with the prices actually paid to the producer.

Detailed and intimate cooperation was undertaken with two organizations of cotton producers at Scott and Atkins, Ark., respectively, who were assisted in the uniform classification and grading of their cotton and who were enabled to cooperate effectively in its sale. A detailed record of the year's business of each of these organizations has been furnished to the department, supplying a large amount of material suitable for publication and demonstrating the possibility of improving the present marketing system by the introduction of cooperative methods.

A temporary moisture-testing outfit was installed in the grading room of the Scott Cotton Growers' Association, where determinations

of the moisture content of freshly ginned cotton were made upon samples taken from some 1,350 bales. Determinations were also made of the moisture in typical samples of seed cotton prior to ginning, and a record was kept of the temperatures developing in the seed which was accumulating for shipment at the gin. Subsequent germination tests were made upon seed which had developed varying degrees of temperature, with the result that some light has been obtained upon the degree of heating which is destructive to the germinating power of the seed.

A detailed investigation of the economic conditions existing in the Sea-Island cotton industry was made, extending through all the regions of production in South Carolina, Georgia, and Florida, and to the consumers of Sea-Island cotton in the United States. The results of this investigation, which seemed to indicate the probability of a decreasing production for the immediate future, were embodied in Department Bulletin 146, Economic Conditions in the Sea Island Cotton Industry.

A number of spinning tests were made in cooperation with the New Bedford Textile School, New Bedford, Mass., on a number of typical bales of eastern long-staple Upland cotton, grown from pure varieties and spun for comparison with Delta cotton at the same settings. The results of these tests are embodied in Department Bulletin 121, Spinning Tests of Upland Long-Staple Cottons, and show that the pure strains of eastern Upland long-staple cotton give less waste than typical Deltas of the same length.

In cooperation with the committee on southwestern cotton culture of the department, five tentative grades for the Arizona-Egyptian cotton crop were established, and material assistance was thus rendered the growers in satisfactorily disposing of this superior product. It appears likely that in normal years the best market for this cotton will be found in England, as few American mills are using Egyptian cotton of such high quality as the Arizona product. Spinning tests were also conducted to show the relative values of the five grades suggested. The results of these tests proved that the plant breeders of the department had developed a strain of cotton of unusual uniformity and spinning value.

Toward the end of the fiscal year special investigations were also made of the methods and practices prevailing in the cotton exchanges for the information and assistance of the committees of Congress engaged in formulating the United States cotton futures act, which has since become a law. At about the same time detailed investigations of the warehouse situation were undertaken. This investigation was first conducted in cooperation with the North Carolina Department of Agriculture, and later prosecuted in similar detail in the State of Georgia. These inquiries were designed to determine the total amount of warehouse space available in these States, the proportion which was available for the use of the farmers in storing their cotton, the rates of storage and insurance charged, the cost of different classes of structures, the variations in insurance rates, and other details. The results of these investigations are being prepared in form suitable for publication, and in their preliminary form they were available for the use of Congress when the United States cotton warehouse bill was formulated. The results of the general primary market surveys were also in such form as to render valuable

assistance to the Agricultural Committee of the House in determining the final form of the cotton standards act now pending.

The work of the office with reference to cotton handling and marketing has been conducted under the immediate direction of the chief, with Messrs. W. A. Sherman, Fred Taylor, and W. R. Meadows supervising the actual work.

COOPERATIVE MARKETING.

Besides the general work on this project, much time and attention has been given to the subject of cooperative organization accounting. This work, which was begun October 1, 1913, was in its turn divided into two parts—a survey of cooperative agricultural marketing organizations, and a study of the systems of accounting and auditing for such organizations.

A survey of the cooperative agricultural marketing organizations throughout the United States was undertaken November 1, 1913. Since that time the names and addresses of over 7,000 organizations have been secured. Questionnaires regarding methods of organization and operation have been sent to all these organizations, and the information received is being tabulated. The names and addresses of a large number of cooperative purchasing organizations have also been secured in this work, and considerable information has been tabulated relating to them.

Accounting forms and descriptions of the systems in use in a number of cooperative organizations have been secured and studied. Personal visits have been made to a number of fruit and produce associations and to grain elevators and cooperative creameries for the purpose of studying the business practices in vogue and their methods of financing. From the information thus secured an accounting system has been prepared for use in grain elevators, and this is now being tried out in cooperation with three farmers' elevators, one at Henry, S. Dak.; one at Breckenridge, Minn.; and one at Finley, N. Dak.

A system for use in small cooperative organizations handling deciduous fruits has been devised, and this is now being tried out in the Delaware Produce Exchange at Dover, Del., and the Virginia Fruit Growers (Inc.), at Staunton, Va.

A system for use in produce exchanges handling potatoes has been devised and is now being tried out in the office of the Long Island Potato Exchange, Riverhead, Long Island, N. Y.

Plans have also been made for the preparation of uniform systems of accounting for cooperative warehouses, canneries, creameries, cotton gins, and meat-packing plants, and for the recommendation of systems of auditing, plans for financing, and methods of business practice for these organizations.

A general accounting bulletin dealing with the business practices of cooperative agricultural marketing organizations has been prepared and is now ready for submittal.

The general work of this project has aimed to strengthen associations already organized and to make their work more efficient, to guide new associations along safe and businesslike methods and away from the common mistakes of such enterprises, to arouse public

interest in the spirit of cooperation, and to emphasize the essentials for successful application of that principle to the farmers' business.

To this end about 20 public addresses have been made before farmers' gatherings numbering from 100 to 3,000 persons. Forms of by-laws and accounting and auditing systems for cooperative associations, egg circles, etc., have been prepared and sent out to over 200 inquiring persons and societies, and aid has been given in drafting articles of incorporation, forms of constitution and by-laws, as well as suggestions on the control and management of farmers' cooperative marketing associations.

In answer to urgent requests, personal visits have been made to more than 30 localities in various States, including Virginia, Kentucky, Maine, Massachusetts, Michigan, Kansas, Missouri, Nebraska, Colorado, Utah, and Idaho. At each of these places the representative of this office studied local conditions and was in conference with farmers' associations. The field work in cooperative marketing is handled by Messrs. Charles E. Bassett and Clarence M. Moomaw, while the work in cooperative organization accounting is carried on by Mr. W. H. Kerr, assisted by Mr. G. A. Nahstoll.

MARKET SURVEYS, METHODS, AND COSTS.

During the early months of the fiscal year the persons primarily assigned to this project were assisting in the surveys of the primary cotton markets, covering the entire belt. During the autumn, however, special investigations were made in regions of principal production as to the quantities of cabbage and onions going into winter storage as compared with the amount so held during the preceding year. This information was secured in time to furnish some guidance to the truck growers of Florida and Texas before their field crops were fully set. This was followed by a survey of the acreage and prospective production of head lettuce in the Florida and South Atlantic as well as the Texas territory, and the conditions in each of these competing areas were made known to the other during the shipping season.

These local and preliminary surveys have been followed by systematic work in building up lists of correspondents from whom to secure special reports on the acreage, prospective yield, market surplus, and crop movement of strawberries, tomatoes, cabbage, onions, peaches, and possibly other specific products during the coming crop season. The object is to acquaint each producing territory with conditions existing in competitive areas and to furnish prompt information to each concerning shipments from the other, with such data as it may be possible to secure on destination and on prices prevailing at terminal markets. A separate list of correspondents has been established for each of these products. The commercial peach movement for 1914 was forecasted from the reports of these special correspondents, and a subsequent inquiry will be made to determine the accuracy of the system. After the methods of handling this phase of market survey work have been tested out, it is planned to handle it in cooperation with the Bureau of Crop Estimates.

The plan is to secure, after the shipping season, accurate and complete figures covering the actual car-lot movement of each of

these crops from all sections, and with the aid of these figures and the reports of field men and correspondents to forecast the next market surplus.

Up to this time there have been listed the following numbers of shipping points where car-lot shipments originate: Strawberries, 890; peaches, 1,912; tomatoes, 509; cabbages, 1,227; onions, 1,138; and inquiries have been addressed to a total of 5,951 growers and 1,143 fruit and truck associations in reference to these crops. It has been necessary, in order to verify the figures given, to address additional inquiries to many of these station agents, growers, and associations. These lists are being completed, and when they are perfected for these and other perishable products this office hopes to have the machinery which will enable it to furnish timely information as to market supplies, which will be of great value to both producers and consumers, as well as to distributors and transportation agencies.

Late in the fiscal year, representatives of the office made extensive trips throughout the truck-producing sections of the southern Mississippi Valley and Texas, with a view to determining exactly what sort of market information would be of most value to the producers, and just what information it would be practicable to obtain from each producing section. Methods of preparation and sale of truck crops were also studied; relative merits of field-packed products as compared with those graded and packed at railway stations were noted; and inspections were made of the condition of packages and products after loading. Fairly detailed inspection of the methods of handling the tomato crop in the Mississippi and Texas districts were thus made. Preliminary inquiries were also made concerning the methods of handling the early potato crop of the Texas and Arkansas districts.

With the close of the fiscal year these studies were transferred to the large distributing markets, where the wholesale and retail distribution of typical shipments of various perishable products has been followed in detail. It is believed the data on certain crops will be sufficient to warrant publication at an early date.

An article entitled "Marketing the apple crop" was prepared and appeared in the Agricultural Outlook of September 16, 1914 (Farmers' Bulletin 620).

In the conduct of this work the chief has been assisted by Messrs. Sherman, Branch, Moomaw, and More, as well as a small field force of market reporters.

MARKET GRADES AND STANDARDS.

Valuable data were secured in regard to State and National laws and commercial customs and requirements concerning weights, measures, grades, and standards for farm products; standards for packages and containers; and cold-storage regulations and requirements.

A great lack of uniformity exists among the various State laws governing each of these different subjects; in fact, many so conflict as to interfere considerably with the marketing and distributing of farm products to the best advantage.

A large collection of typical boxes, crates, and carriers has been made from various sections for study and demonstration.

Suggestions and information have been given upon request to many growers and shippers by correspondence and by demonstrations in the field in regard to grading and packing. In nearly every section the advantages to be gained by some system of individual or cooperative effort toward placing the crop on the market properly graded and packed in suitable containers is manifest. Field studies have covered the harvesting, grading, packing, hauling, and loading of selected perishable crops.

Present investigations include a comparison between the results secured by scattered field packing and those obtained in track packing houses, or by community packing.

Work under this project has as yet been closely associated with that under market surveys, methods, and costs, and has not progressed to a point where the two may be entirely separated.

The actual conduct of market grades and standards work has been in the hands of Mr. C. T. More, assistance being assigned from other projects whenever necessary.

CITY MARKETING AND DISTRIBUTION.

The work in city marketing and distribution is under the immediate management of Mr. G. V. Branch, and during the past year it has been possible to combine some practical and beneficial work with the investigational efforts connected with the project. The city has proven to be the home of both acute and chronic marketing ailments, and offers a multitude of problems which demand attention.

Many cities are awaking to the wasteful conditions which surround the marketing of farm products, and several marketing surveys have been made in such municipalities as have requested aid of this office. Investigations have been carried on at Jackson, Mich., Providence, R. I., Trenton, N. J., Philadelphia, Pa., St. Louis, Mo., and Washington, D. C. Extensive reports to the interested agencies, containing advice and suggestions for improving marketing facilities, have followed these investigations.

There has been an increasing demand from municipal governments for practical and authoritative information relating to the many questions involved in the establishment of city-owned public markets, both wholesale and retail. To answer these calls it has been necessary to conduct extensive investigations into all phases of public market activity. Personal trips to acquire first-hand information have been made to Boston, New York City, Norfolk, Baltimore, Albany, Rochester, Cleveland, Buffalo, Pittsburgh, Cincinnati, Toledo, Denver, Des Moines, Dubuque, St. Louis, and Madison. As a result of these visits, several cities have been able to increase the efficiency of their markets. A large number of municipalities have been advised and aided through correspondence.

Plans have been made to cooperate with the District of Columbia in working out a demonstration project along this line, using Washington's six markets in the work. Assurance has been received from other cities that they will be glad to cooperate with this office

in testing out ideas that it may advance which are aimed to improve the efficiency of municipally owned markets.

Although nearly every large city is suffering from inadequate terminal facilities, very few have turned their attention to the possibilities of properly constructed wholesale terminal markets for the handling of incoming perishable products. Comparatively few cities have even the advantages of perishable-freight yards, where track selling may be conducted, thus obviating the necessity of several extra drayages and handlings. Considerable study is being made by the office of the most practical and approved methods of dealing with perishable food products at terminals.

Each of the many methods used in getting foodstuffs to the consumer has its quota of overhead costs. The study and comparison of these costs and the services which the various methods of distribution render to the consumer are now under way. It is hoped that these investigations will demonstrate as to which agencies are most efficient in the work.

TRANSPORTATION AND STORAGE PROBLEMS.

The initiation of studies in transportation and storage was assigned to Mr. G. C. White, transportation specialist.

An investigation of the problems relating to the transportation and storage of farm products was begun December 1, 1913. The demurrage laws and regulations effective in the various States on both State and interstate traffic have been compiled and digested. A manuscript has been prepared containing this digest and indicating how the agricultural industry is affected by existing regulations and practices in the matter of car supply and the marketing of farm products. A partial survey has been made of precooling plants and facilities under private and railroad ownership throughout the country, including location of such plants and system of precooling used.

The freight service furnished by electric railroads, both urban and interurban, has been surveyed, with special reference to ascertaining the facilities afforded farmers and dairymen in the marketing of their products. A special study was made in Massachusetts of the methods used by the electric railroads serving the metropolitan district of Boston in the transportation and distribution of farm products.

An investigation of the special service furnished by steam roads in the matter of iced pick-up cars and special market trains is in progress.

The effect on production and distribution of rigid regulations regarding guarantee and prepayment of freight charges on perishable commodities in the Southeast has been investigated in collaboration with a representative of the Interstate Commerce Commission by means of visits to points in the States of Virginia, North Carolina, and Florida and by conferences with growers, shippers, and traffic and claim officials of the principal railroads of those sections. A study of the effect of increased freight rates on consumption of fruits and vegetables in the territory depending on distribution from Pittsburgh has been made by personal investigation among the dealers of Pittsburgh and the jobbers of surrounding towns in connection with hearings by the Interstate Commerce Commission. Many specific inquiries have been answered and much special information has been

given by correspondence and in conference in seeking solutions of the problems connected with the transportation and storage of farm products.

It is planned to continue investigations on various roads for different farm and food products and in different sections of the country as the basis for outlining reports of movement of principal commodities from producing sections to consuming centers; to ascertain extent of electric line freight service now offered producers marketing in Washington City and the extent of the demand for, and probable effect of, additional service; to study car supply for moving crops to market; and to make a survey of the amount of commercial cold storage available throughout the United States.

An article on "Car supply in relation to marketing the wheat crop of 1914" was prepared, and appeared in the Agricultural Outlook of July 21, 1914 (Farmers' Bulletin 611).

MARKETING BY PARCEL POST.

Under directions of the chief of office, and in direct cooperation with the Post Office Department, work was begun under this project on September 25, 1913, by Mr. L. B. Flohr. Numerous trips have been made in mail cars, the investigator traveling practically as a member of the mail-car crew, for the purpose of getting first-hand knowledge of the conditions under which parcel-post matter is handled, with especial reference to perishables. Studies were also made as to possible necessity for changes in equipment, and in the regulations for handling and dispatching parcel-post matter, with especial reference to marketing farm and food products by parcel post.

Detailed studies of the marketing of certain specified commodities by parcel post have also been made. A very thorough investigation of the shipping of eggs, which were supplied by the Bureau of Animal Industry, in family-size lots of from 1 to 10 dozens was made, and many different styles and makes of patented and unpatented containers were thoroughly tried. This investigation was brought to a close in February, 1914, and a full description of the study, with the results, was given in Farmers' Bulletin 594, Shipping Eggs by Parcel Post. As a result of this publication many inquiries regarding containers and proper packing for shipment have been received.

Extensive experimental shipments of butter have been made from creameries to the Office of Markets, and from the office to agricultural experiment stations throughout the country. Several kinds of containers and wrappers are being used in order to determine the requirements of a container which will carry butter successfully when liable to exposure to high temperatures.

Studies of the possibilities of shipping fruit have included 28 crates of strawberries, which were handled successfully by parcel post. Four of these were shipped from West Falls Church, Va.; the other 24 from Hobbs, Denton, and Ridgeley, all in Caroline County, on the Eastern Shore of Maryland. Twenty crates of cherries were also shipped from Lancaster County, Pa., Adams County, Pa., and Morgan County, W. Va. These uniformly ar-

rived in good condition, with the exception of 2 crates which were delayed in delivery from Saturday until Monday, and as a result had somewhat deteriorated.

Numerous experimental shipments of vegetables have been made, including 8 or 10 barrels of lettuce, which were received from the Arlington Experiment Farm, and shipped out in different-sized parcels to various parts of the country, including Boston, New York, Philadelphia, Detroit, Chicago, and Minneapolis. Considering the weather conditions, including temperature at times below zero, the lettuce carried in a satisfactory manner. Numerous experimental shipments of assorted vegetables were made during the fall of 1913 and the spring of 1914, with uniformly satisfactory results when conditions were not abnormal.

In order to make a practical study of the actual process of direct dealing, one person was assigned to work in the city of Atlanta, and in the first and second zones having that city as a center. His duty was to find producers who had certain kinds of produce to sell and to find consumers in the city who wished these commodities. This work has progressed to such a point that it is believed that definite conclusions can be reached within six or eight weeks.

MARKETING ANIMAL PRODUCTS.

The principal activities under this project have had to do with the marketing of dairy products. The office is cooperating with the extension department of the Massachusetts Agricultural College in a detailed study of the cost of milk distribution in a large number of typical Massachusetts cities of different sizes.

Cooperative relationships have also been established with the University of Minnesota, the State Dairy and Food Commission of that State, and the Dairy Division of the Bureau of Animal Industry in an investigation of the methods and costs of handling and marketing butter, with special reference to the business of the cooperative creameries in Minnesota.

In cooperation with the College of Agriculture and the Agricultural Experiment Station of the University of Wisconsin, an investigation of the handling and marketing of butter and cheese has been undertaken, and the greater part of the time of a specialist in dairy marketing will be devoted to work in these two States during the present year.

Preliminary investigations have been made on the methods of handling and distributing live poultry in the New York and Boston markets and of the methods of assembling in producing regions. It has not been practicable as yet to assign anyone to a detailed study of this problem, but the fact that the business is attended by considerable losses and that gross abuses have existed in the matter of overfeeding poultry just before offering for sale has been fully substantiated.

Late in the fiscal year the services of Prof. L. D. Hall as specialist in marketing live stock and meats were secured, and inquiries were immedately instituted as to the organization and management of municipal abattoirs. Subsequently a system of following typical live-stock shipments was adopted, involving a careful compilation of

methods of handling and costs and wastes attending each step in the marketing process from the farm or ranch to the consumer's table. These studies constitute a part of the inquiry into the economics of the meat situation instituted by the Secretary of Agriculture.

DEPARTMENTAL COOPERATION.

It is the desire of this office not to duplicate any work which is already being done elsewhere, and to this end departmental cooperation is engaged in rather extensively. Mention has already been made of specific instances, but it is desired here to emphasize the cooperation of the Bureau of Animal Industry in all lines of work on the marketing of live stock and animal products, in cooperative organization, and in parcel-post work; of the Bureau of Plant Industry in many lines of cotton work, in work on market grades and standards, in transportation and storage, and in parcel-post work; of the office of the solicitor in compiling and digesting many laws, both State and National, of which this office needs knowledge in prosecuting its work, and in rendering decisions on matters relating to cooperative organization and other legal questions.

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